TheCenter

Measuring and Improving Research Universities: TheCenter at Five Years

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December 2004

An Annual Report from
The Lombardi Program on Measuring University Performance

Contents

Acknowledgments

The authors gratefully acknowledge the support of Mr. Lewis M. Schott, whosegenerous contribution established the Lombardi Program on Measuring UniversityPerfomance.

Measuring and Improving Research Universities: *TheCenter* at Five Years

Introduction

This report marks the first five years of *TheCenter's Top American Research Universities*. Over this period, we have expanded the scope of these reports, we have offered some observations on the nature of the research university and its competitive context, and we have provided our colleagues with a stable and consistent collection of reliable indicators. The work of *TheCenter's* staff has involved all of us in a wide range of conversations with colleagues at other universities, with associations and conferences, and on occasion with colleagues overseas. These discussions and presentations have helped us test our methodology. Much of the comment on *TheCenter's* methodology turns on two primary issues. The first is our focus on campus-based institutions, and the second is our emphasis on aggregate measures.

Our initial approach to the question of measuring university performance came from a commitment to institutional improvement. Campuses seeking improvement need reliable national indicators to help them place their own performance within a national context. In several essays, we explored the nature of this context as well as discussed the operational model of research universities and the structural implications of state university system organization. These discussions have enriched our understanding and reinforced our conclusion that a campus' performance is the critical indicator of institutional competitiveness.

Some state systems prefer to present themselves to their statewide constituencies as if they were a single university with a common product, but students, parents, faculty, and other institutions immediately recognize that the products of different campuses within the same system vary significantly. The system approach has value for explaining the return on a state's public investment in higher education, but it provides a less effective basis for measuring institutional performance. We discuss some of these issues in more detail in this document where we review system performance measures and compare them to campus performance to provide a perspective on scale and utility of these views of institutional activity. In some states, moreover, systems serve to protect the campuses against legislative or other forms of inappropriate interference. In highly politicized contexts, systems prefer to report only system-level data to prevent misuse of campus-specific data. For these and other reasons some multi-campus institutions remain committed to viewing themselves as single institutions on multiple campuses. While we respect that decision, we nonetheless attempt to separate out the performance of campuses in our presentation of data.

The second major issue involves the question of aggregate versus some relative measures of performance of research universities. *TheCenter's* data reports an aggregate measure of performance in all but one instance (the SAT scores), whether it is the institution's total research, its federal research, its awards, or the like. Each of these measures (with the exception of the SAT score, which the College Board reports as a range) appears without any adjustment for the size of the institution, normalization by number of faculty, adjustment for size of budgets, or any other methods of expressing performance relative to some other institutional characteristic.

While size, for example, is of some significance in the competition for quality faculty and students, the size variable is not easily defined. We have made some estimates in our 2001 and 2002 reports in an attempt to identify the impact of institutional size (whether expressed in terms of enrollment or budget). In some circumstances size is an important variable; but this is not universally so. Public institutions with large enrollments have an advantage over public institutions with small enrollments in many cases, but not in all. Private universities benefit much less, if at all, from large student enrollments. We do know that the amount of disposable income available to an institution after deducting for the base cost of educating students appears to provide a significant advantage in the competition measured by our data. However, reliable data on institutional finances remain elusive, and we consider our findings in this area indicative but not necessarily definitive.

If the data on enrollment and finances prove inadequate to help us measure the relative performance of institutions, the data on faculty are even less useful. As we discuss in more detail below, the definition of "faculty" varies greatly among institu-

tions, and the proportion of faculty effort devoted to research rather than to teaching, administration, or service is usually unavailable in any comparable form. These two defects in the data reported publicly by universities render all attempts to normalize institutional performance by faculty size misleading.

Absent reliable, standard measures , the data collected and reported by TheCenter remain the best current indicators for tracking competitive performance over time.

Until reliable, standard measures appear for many of the quantities that interest all of us who seek effective measures of institutional performance, the data collected and reported by *TheCenter* will remain the best current indicators for tracking competitive performance over time. In reaffirming our focus, we must continually emphasize that *TheCenter's* data do not identify which institution is "better" or which institution is of "higher quality." Instead, the data show the share of academic research productivity achieved by each campus represented in the data. It is entirely possible that some of the faculty in a small institution, with a small amount of federal research, are of higher quality than some of the faculty in a large institution, with a large amount of federal research. However, it is surely the case that the institution with a large amount of federal research has more high-quality, nationally competitive faculty than the institution with a small amount of federal research.

TheCenter primarily measures market share. For example, the federal research expenditures reported for each institution represent that institution's share of all federal research expenditures. That Johns Hopkins University (JHU) spends more federal research dollars per year than the University of Maryland-Baltimore County (UMBC) is indisputable, and that JHU has more people engaged in federally sponsored research activity than IMBC does is virtually certain. This does not mean, however, that the best faculty members at UMBC are less competitive than the best faculty members at JHU. It means only that the JHU faculty have succeeded in competing for more federal research awards leading to higher annual expenditures.

This distinction, often lost in the public relations discussion about which campus is the best university, is of significance because each campus of each university competes against the entire marketplace for federal research dollars (and other items captured in *TheCenter's* data). When Johns Hopkins' faculty or when the University of Maryland-Baltimore County's faculty win awards, they do so in competition with faculty based at institutions all over the country. The university competition reflected in *TheCenter's* data measures the success of each institution's faculty and staff in competition against all others – not the success of each institution in a competition against a presumed better or worse institution in some ranking. This frame of reference gives *TheCenter's* data its utility for institutions seeking reliable ways of measuring their improvement because it indicates institutional performance relative to the entire marketplace of top research universities. Although *TheCenter* ranks institutions in terms of their relative success against this total marketplace, it is not only the ranking or the changes in ranking that identify competitive improvement but also the changes in performance relative to the available resources. If the pool of federal research expenditures controlled by those universities spending $20 million or more grows by 5% and an institution increases its federal expenditures by 3%, it has indeed improved, but it has lost ground relative to the marketplace. This context helps place campus improvement programs into a perspective that considers the marketplace within which research universities compete.

From the beginning, *TheCenter* posted online all the data published in *The Top American Research Universities* and variety of other data that universities might find useful in understanding and interpreting research university competitiveness in a format that permits downloading and reanalysis. This feature has proved particularly helpful to institutional research offices, and comments from many colleagues indicate its value. The Web statistics compiled each year for the annual meeting of *TheCenter*'s advisory board also indicate the value of the online presentation of data. Although we distribute about 3,000 copies of the report each year, primarily to university offices on research campuses, the hit rate on the Web site indicates that the reach of *TheCenter's* work is considerably larger. We note in particular a significant interest overseas, as more institutions see the competitive context as international and as more institutions outside the United States seek ways of measuring their own competitiveness. This interest also has prompted consultations and papers from *TheCenter* staff.

While we have been pleased with the reception given this effort by our colleagues, our review of *TheCenter's* impact offers some lessons for improved effectiveness. Many in our audiences have found the

essays at the beginning of each report of considerable interest, either because they treat topics of current interest or because they have proved useful in educating trustees and others about the context of research university competition. At the same time, the essays' inclusion in the report has limited their visibility in the academic community, and we have begun to reconsider the practice of bundling the topical essays with the report. As the prevalence of Web-based distribution of specialized publications continues to expand, we also have begun a review of the current practice of publishing a paper report. While some audiences, particularly trustees and other participants in the larger policy debates, may find the paper copy more accessible, the professionals who use the data may well see the Web-based product as sufficient.

In any event, these five years have provided the occasion to develop a useful set of data and have offered an opportunity to contribute to the conversation about university competitiveness and improvement. We remain grateful to Mr. Lewis Schott, whose gift to the University of Florida made this report possible. We also are grateful to the University of Florida for continuing to serve as the host institution for the *TheCenter's* activities and to the University of Massachusetts Amherst and The State University of New York for their continued support of the co-editors.

TheCenter's Framework

Research universities live in an intensely competitive marketplace. Unlike commercial enterprises that compete to create profits and enhance shareholder value, research universities compete to collect the largest number of the highest-quality research faculty and research productivity as possible. They also compete for the highest-quality but not necessarily the largest number of students.

Because the demand for these high-quality students and faculty greatly exceeds the supply, research institutions compete fiercely to gain a greater share of these scarce resources. Although the process of competition is complex and has different characteristics in different segments of the research university marketplace (small private institutions and large public universities, stand-alone medical institutions and public land grant universities, for examples), the pursuit of quality follows the same basic pattern everywhere. Talented faculty and students go where they believe they will receive the best support for developing their talent and sustaining their individual achievement in the many marketplaces for their skills. Research universities compete to capture and hold talented individuals in the institution's name, and individuals compete with other individuals for the recognition of their academic accomplishments. This competition takes place in a national and international marketplace represented by publications in prestigious journals and presses, grants won in national competition, prizes and awards recognizing exceptional academic accomplishments, offers from increasingly prestigious institutions, desirable employment post-graduation or placement in prestigious post-graduate programs, and similar tokens of national or international distinction.

The work that defines a research university's level of competitive performance appears in the accumulated total productivity of its individual faculty, staff, and students. The importance of individual talent in the research university marketplace helps explain the strategies institutions pursue to enhance their competitiveness. Although faculty talent is mobile, the infrastructure that supports their creativity and productivity is usually place bound. Institutions, universities, and medical centers build elaborate and often elegant places to capture and support high-quality faculty. They provide equipment, lab space, staff, and research assistance. They build libraries and offices, pay the substantial cost of research not covered by grants or external funds, support the graduate students essential for much faculty research, and in most places recruit the best undergraduates possible for the faculty to teach and to create the campus life that attracts many research faculty.

The research university's competitive performance appears in the total productivity of its individual faculty, staff, and students.

The American research university enterprise operates within a complex multilayered organizational, managerial, and regulatory framework. With elaborate bureaucracies and highly structured organizational charts, research universities resemble modern corporations on the surface. Operationally, however, especially at the faculty level, they are one of the last of the handicraft, guild-based industries in America, as described in our 2001 report. Faculty organize themselves into national guilds based on the methodologies and subject matter of their disciplines. Chem-

ists and biologists use different methods and tools to investigate different subsets of the scientific universe. While many topics at the edges of these guild boundaries overlap, and produce such fields as biochemistry, the guilds define themselves by the center of their intellectual domains and not the edges.

The national nature of the guilds reflects the mobility of faculty talent. A historian in California today may be a historian in New York tomorrow. The historians' guild remains the same, and the criteria used to define historical excellence are the same on both coasts. The university does not define the standards of excellence; the faculty guilds do. A university can accept individuals who do not meet guild standards, but it cannot do so and remain competitive. Evaluating and validating quality requires the highest level of very specific expertise. Few observers outside the guild have sufficient expertise to identify and validate quality research at this level, and so the university requires the national guilds to certify the quality the institution seeks.

Although faculty research talent is individual, high-quality faculty become more productive when they work in contexts with significant numbers of other high-quality faculty. Not only is it easier to recruit a high-quality faculty member to join a substantial group of similarly distinguished colleagues but the university can support 10 first-rate chemists much more effectively than it can support one. University quality, once established at a high level and substantial scale, becomes self-sustaining. We describe the structure and operation of the research university in the 2001 report as quality engines, and we explain the relationships that link academic guilds to their organizational structure within colleges and schools, and to their relationship with the university's administrative shell.

The key question for every research university is how to engage the competition for quality. The most important element in every research university's strategy is a set of indicators – measures that allow a clear and objective method to assess how well the institution competes against the others among the top research universities. Constructing such reliable measures proves exceedingly difficult, even though every university needs them. These difficulties fall into various categories.

Compositional difficulties refer to the widely differing characteristics of research competitive institutions. Some have large undergraduate populations of 30 thousand or more while others support five, one, or even fewer than one thousand undergraduates. Competitive research universities can encompass practically every known academic and research specialty while others concentrate on medical sciences, engineering, or the liberal arts and sciences. When we compare institutional performance across this widely diverse universe, we encounter significant difficulty interpreting the data as discussed in our 2001 report.

Organizational difficulties occur because research universities often exist within complex governance structures. Most private institutions have relatively simple organizational arrangements with a single board of trustees governing one university campus. Public institutions, however, operate within a wide range of different and often complex governance systems, often with multiple institutions governed by single boards and elaborate control structures applied to multiple campuses. These public models respond mostly to political considerations and can change with some frequency. In our 2002 report, we discuss whether these different organizations have an influence on the research effectiveness of the institutions they govern, rendering comparisons of institutions difficult to interpret.

Money differences also distinguish research universities. All research universities derive their revenue from the same general sources, although in significantly different percentages. These sources include:

- student tuition and fees;
- grants and contracts for research and services;
- federal and state funds achieved through entitlements, earmarks, funding formulas, or special appropriations;
- income from the sale of goods and services including student housing and dining, various forms of continuing and distance education, interest on deposits, and other smaller amounts from such services as parking;
- clinical revenue from medical services provided by university faculty and staff;
- income from private funds located in endowments or received through annual giving programs; and
- income from the commercialization of intellectual property in licensing, patents, and royalties.

Public and private universities have different revenue structures, with many public research institutions having significant portions of their operating

and capital budgets provided by their state governments from tax revenue. Private institutions, while they often have special subsidies from the state for special projects or through per-student subventions for in-state students attending the private institution, nonetheless have a much smaller percentage of their budgets from state dollars in most cases. In contrast, private universities usually have higher average tuition per student than most public institutions, although often the out-of-state fees charged by many public institutions reach levels comparable to the discounted tuitions of many but not all private institutions.

All major research universities, public or private, have large expenditures from grants and contracts for research and services. The most prestigious of these federal grants come from agencies such as the National Institutes of Health (NIH) and National Science Foundation (NSF) that use competitive peer-reviewed processes to allocate funding, but all institutions seek contract and grant funding from every possible source – public, private, philanthropic, or corporate. In most, but not all, cases, private institutions tend to have a larger endowment than public universities, although in recent decades aggressive fundraising by prestigious public institutions has created endowments and fundraising campaigns that exceed many of their private research counterparts. The income from these endowments and the revenue from annual campaigns that bring current cash to the institutions provide an essential element to support high-quality, research university competition.

Most observers recognize that the revenue available to any institution is critical to the successful competition for talented faculty and students, but measuring that revenue in an effective and comparative way proves difficult, as we outline in our 2002 report. One of the challenges involves higher education capital funding, especially in the public sector. Public universities have many different ways of funding and accounting for the capital expenditures that build buildings and renovate facilities. In some states, the university borrows funds for this purpose on its own credit, and the transactions appear fully accounted for on the university's books. In other states, however, the state assumes the debt obligation and builds the institution's academic and research buildings. The debt and payments can appear in different ways on the state's books, often combined with other state capital expenditures either for all of higher education or all public construction.

It usually proves impossible to get good comparable data about university finances. In the case of research universities, this is particularly important because the availability of good research space is a critical element in the quest to attract the best research faculty. In our 2002 report we discuss a technique to approximate the amount of disposable revenue available for a university to invest in supporting research and higher-quality instruction, after allowing for the base cost of instruction. Full exploration of the issue of revenue and expenses relies mostly on case studies of particular university circumstances among relatively small subsets of institutions. Comparison of numbers such as annual giving and endowments provides a sense of the relative wealth available outside of the general revenue from tuition and fees, grants and contracts, and other sources of earned income to support quality competition.

Ranking and Measurement

Given the complexity of the research university marketplace, reliable indicators of university performance are scarce. Nonetheless, colleges and universities of all types and especially their constituencies of parents and alumni, donors and legislators, and high school counselors and prospective students all seek some touchstone of institutional quality – some definitive ranking that takes all variables into account and identifies the best colleges in a clear numerical order from No. 1 on down.

Any reasonably well-informed person knows immediately that such a ranking is not possible in any reliable or meaningful way. Yet, commercial publications continue to issue poorly designed and highly misleading rankings with great success. Many things contribute to this phenomenon of the high popularity of spurious rankings.

The most obvious is that Americans have a passion for the pursuit of the mythical No. 1 in every field – the richest people, the best dressed, the tallest building, the fastest runner, the No. 1 football team. This cultural enthusiasm includes an implied belief that the status of No. 1 is a fragile condition, likely to disappear or decline within a year or less. The popularity of most rankings rests in part on the expectation that, each year, the contest for No. 1 will produce a new winner and the rankings of the other players will change significantly. The ranking summarizes this competitive drama at the end of each cycle.

This model of human behavior in competition may work well for track-and-field events, or basketball seasons. It may serve to categorize relatively standardized quantities such as wheat production or rainfall amounts. However, it fails miserably in

accurately classifying higher education institutions that are not only complex and different but whose performance does not change dramatically or significantly on annual cycles.

Yet the ranking industry thrives. Even when college and university leaders recognize, mostly in private, that the published commercial rankings are unsound, they nonetheless celebrate in public those rankings in which some aspect of the institution ranked highly. In these cases, the right answer justifies faulty measurement. If we want 2-plus-2 to equal a rank of 1, we celebrate those who say the answer is 1, we publicize the result of 1, and we allow the error in calculation to pass unchallenged. If the calculation of 2-plus-2 produces an undesirable ranking of 100, then we focus our attention on the serious flaws in a ranking that gives the wrong answer, whatever its methodology.

The popularity of college and university rankings reflects the complexity of American higher education and the remarkably standardized nature of their undergraduate curricula.

Perhaps a more fundamental reason for the popularity of college and university rankings reflects the extraordinary complexity and variety of American higher education institutions and the remarkably standardized nature of their undergraduate curricula and programs. Observers have great difficulty distinguishing the relative value of institutions because their undergraduate products appear so similar. The rankings offer the illusion of having resolved this dilemma by producing a set of numbers that purport to be accurate tokens of widely differential relative value.

We, along with many other colleagues, have reviewed the methodological fallacies and other errors in the most popular ranking schemes. These critiques, even though devastatingly accurate, have had minimal impact on the popularity of the rankings and indeed probably have contributed to the proliferation of competing versions.

Aside from the obvious public relations value of rankings and the American fascination with lists of this kind, a more fundamental reason for their success and popularity has been the lack of any reasonable alternatives based on quality, standardized data from the institutions themselves. Colleges and universities have few incentives to provide the public with accurate, systematic data useful for good measurement of the products they produce. Although some observers think this responds to a cynical disregard of the public's right to know and an effort to disguise poor performance (which may well be a minor item in the larger context), the real reason for the reluctance of institutions to provide data useful for comparative purposes is a justifiable concern about how others might use the data.

If the data were good, they would account for institutional complexity. Universities, however, are remarkably complex and highly differentiated in organization, composition, purpose, and financing. At the same time, they produce similar if not identical products. Many university leaders fear that the provision of standardized data that do not take into account significant institutional differences will lead to invidious and inaccurate comparisons among universities or colleges of much different type that produce virtually identical products of identical quality.

As an example, an urban institution with large numbers of part-time enrollees that serves at-risk students from families with low-to-modest annual earnings and with poor high school preparation nonetheless produces the same four-year baccalaureate degree as a suburban residential college that admits only highly qualified students from exceptional high schools whose parents have substantial wealth. A common and easily computed measure is graduation rate, which measures the percentage of those students who enroll first time in college and then graduate with a completed –four-year degree by year four, five, or six. The elite college may have a rate in the 80%-90% range, and the urban school may have a rate in the 40% range. Legislators, parents, and others take this simple, standardized measure as representing differences in educational performance by the colleges and attack the urban institution for its failure to graduate a higher percentage of those enrolled. This kind of response is familiar to university and college people, and in reaction they often reject most standardized measurement.

The reasons for differential graduation rates are many. Two identically positioned institutions with identical student populations could have different graduation rates either because they differ in the quality of their instruction or because they grade all students with a passing grade. The graduation rate by itself tells nothing about the performance of the

institution or its students unless we know a lot more about the institution, its instructional activities, its grading patterns, and the quality and preparation as well as economic circumstances of its students. For example, if the full-time institution has students who arrive from elite high schools with advanced placement courses, then the full-time institution's students will have fewer courses to complete for a four-year degree than will students who arrive in higher education without these advantages.

Does this mean that an indicator such as graduation rate has no value? Of course not. What it does mean is that its primary value is in measuring change over time in a single institution and within the context of that institution's mission. However, regulatory agencies, the press, legislators, trustees, alumni, and other observers frequently misrepresent or misunderstand these indicators. In response, institutions resist standardized measures as much as possible. Instead, institutions may provide difficult-to-misuse data, or data unique to the institution that is difficult to compare. In some cases, if a standardized measure will make the campus appear successful, even if the data underlying it are suspect, the institution will publicize the data for public relations purposes.

Particular Difficulties in Undergraduate Rankings

Many observers have difficulty recognizing the remarkable formal uniformity of the undergraduate educational product of American higher education. Thanks to accreditation systems, the pressure of public funding agencies in search of standards for financing higher education, the need for common and uniform transfer rules among institutions, and the expectations of parents, most undergraduate education in America conforms to a standardized pattern of 120 credit hours of instruction delivered within a full-time four-year framework. Whether the student begins in a community college and transfers to a four-year institution, or begins and graduates at an elite private four-year college, this pattern is almost universal in the United States. Accreditation agencies speak to this norm, parents expect this norm, public agencies fund this norm, and graduate or professional education beyond the baccalaureate degree anticipates student preparation within this norm.

This norm, of course, does not apply exactly to every student because many take longer than four years to complete, many pursue higher education at multiple institutions through transfer processes, and others start but never complete a four-year degree. Nonetheless, this standardized frame not only specifies the normal amount of time on task (120 credit hours for a liberal arts degree) but also includes standardized content with a core curriculum taken by all students and a major specialization that prepares students for specific work or advanced study. Even when the rhetoric surrounding the structure of the curriculum varies from institution to institution, the content of organic chemistry, upper-division physics, calculus, accounting, American history, or engineering vary little from institution to institution. The pressure of accreditation agencies in such fields as engineering and business and the expectations for graduate students in medicine, law, and the liberal arts and sciences impose a narrow range of alternatives to prepare students for their post-graduate experience. This, in addition to the expectations of many employers, combines to ensure the uniformity of undergraduate experience. All four-year institutions produce student products for the same or similar markets. Consequently, these products tend toward the standards consumers expect of their graduates.

As we indicated above, the competition for quality students is particularly fierce among high-quality four-year colleges and universities, but because of the standardized nature of the curriculum, it is difficult to compete on instructional content. Instead, institutions focus on other issues. They speak to the "experience" of the student as distinguished from the knowledge acquired by the student. They speak to the activities available for students beyond the classroom as distinguished from the standard context of the classroom. They talk about the quality of the facilities, the amenities of the campus, and the opportunities for enhancements to the standard curriculum in the form of overseas studies, internships, and similar extracurricular activities. They emphasize the small size of the classes rather than the amount of knowledge acquired by students during their education. These contextual characteristics of an undergraduate education are easier to advertise and display than differences in the actual quality of instruction that may take place in classes taught by better or worse faculty to well- or poorly prepared students.

Indeed, few institutions have a clear plan for measuring the amount of knowledge students acquire during the course of their passage through the four-year frame of an undergraduate degree. Do students who attend part-time, do not participate in extracurricular activities, and live at home acquire less knowledge than those who attend full-time, reside on campus, and participate intensively in campus life

throughout the four years of their residence at the college? Much research has attempted to find a way of measuring these effects, but, for the most part, the results have been inconclusive. While students who attend continuously for four years at institutions that recruit students from high-income families with excellent high school preparation appear to have an advantage in the marketplace after graduation, the difference is minor compared to advertised advantages and price differentials. Moreover, the differences do not appear to flow necessarily from the knowledge acquired in the standardized curriculum through the instruction of superior faculty but perhaps from the associations and networks developed among students and alumni by virtue of participation at the institution rather than by virtue of the content of the education provided.

Most institutions publicize the unique context of their standardized curriculum rather than document the differential quality or success of their classroom work.

Some data do exist on the knowledge acquired by college graduates though standardized tests for admission to medical school (MCAT), graduate school (GRE), or law school (LSAT), for examples. However, few institutions collect this information in ways that would permit effective institutional comparisons of performance. Only some four-year institutions would have sufficient percentages of their graduates taking these exams for the standardized test results to serve as national metrics, although these results surely would be useful indicators for the highly competitive research institutions that have been our focus.

Performance Improvement

Most institutions avoid large-scale public comparisons based on standardized data. They see little advantage in such exercises because the data used are often so poor. They believe it more effective to publicize the unique context within which they deliver their standardized curriculum than to explain and document any differential quality or success that their classroom work might produce.

Nonetheless, most university people want to improve their institutions. They want to have more success in every dimension—from acquiring resources to attracting first-rate students and faculty, from driving research performance to enhancing their prestige among their peers. The literature on performance improvement in higher education is endless and endlessly creative. Journals, higher education associations, conferences, and foundations all focus on these issues. Elaborate budgeting schemes attempt to motivate and reward improvement. Complex evaluation and accountability structures, particularly popular in public higher education, consume the time and energy of faculty, staff, and students. Much of this activity falls into the area of fad—popular but short-lived enthusiasms that create flurries of activity, much reporting and meeting, and little practical effect.

Those involved in the accountability movement and the institutional improvement process over long periods can easily become cynical about these recurring enthusiasms for reform using innovative and clever systems, many derived from corporate fads of similar type. Often the university will become the last implementation of a corporate fad whose time has already passed, whether it is Zero-Based Budgeting, Total Quality Improvement, Six-Sigma, or any of a number of other techniques designed to drive corporate quality control and profitability and proposed as solutions to the higher education production environment.

These usually fail—not because they lack insight and utility but because they do not fit the business model of the high-quality research university. Although research universities have a number of surface characteristics that make them look like modern corporations, as we have mentioned above and discussed at length elsewhere, they do not function like modern corporations.

Before we turn to a discussion of the indicators that can drive improvement in performance, we have to be clear about the performance we seek to improve. Research universities have a business model that seeks the largest quantity of accumulated human capital possible. This model does not accumulate human capital to produce a profit; it does not accumulate the capital to increase individual wealth, provide high salaries for its executives and employees, or generate a return on investment to its stockholders. The research university accumulates human capital for its own sake. The measure of a research university's success as an enterprise is the quantity of high-quality human capital it can accumulate and sustain.

Because the accumulation of this capital takes place at the lowest level of the institutional organization—the academic guild or discipline—all incentives and measurements in the end focus on the success of the guild. The rest of the institution—the administration, physical plant, housing, parking, accounting services, research promotion, fundraising, legislative activity, student affairs, instructional program enhancements, and every other like activity—exists to attract and retain both more and better-quality human capital. Some of this capital is short-term, student human capital with a replacement cycle of four to six years. Some of it is longer-term, faculty human capital with a replacement cycle of 20 years or more.

This business model provides us with a clearer focus on what we need to measure, and how we need to manage investments to improve any major research institution. Although the focus here is on human capital accumulation, the most important single element in the acquisition of high-quality human capital is money. All other things being equal, the amount of money available to invest in attracting and retaining human capital will set a limit on a university research campus' success. Of course, not all things are equal, and institutions with good support systems, effective and efficient methods for managing physical plant and supporting research, and creating exciting environments for students will get more from each dollar invested than those places with inefficient and ineffective administration and support. Nonetheless, while good management can multiply the effectiveness of the money spent on increasing human capital, good management cannot substitute for lack of investment.

Within this business model, then, are two places to focus measurement in order to drive improvement. The first is to emphasize revenue generation. The second is to measure faculty and student quality. In higher education, as in most other fields, people tend to maximize their efforts and creativity on what their organization measures; as a result, a clear focus on measurement is particularly helpful. In universities, moreover, when few people's motivation is profit oriented (primarily because the personal income increase possible from an added amount of university-related effort is very small) the competition normally turns on quality, which produces prestige. Indicators of quality, then, create a context for recognition of prestige differences.

While individuals in research universities have rather narrow opportunities for personal income enhancement through the university, they have substantial opportunities for prestige enhancement through institutional investment in the activities from which they derive their prestige. A superb faculty member may make only 150% of the salary of a merely good faculty colleague, but the institution can invest millions in supporting the work of the superb faculty member and only hundreds of thousands in the work of the good faculty member. The multiplier for faculty quality is the institutional investment in the faculty member's work rather than the investment in the individual's personal wealth. The institution must pay market rates for high-quality faculty, but the amount required to compete on salary is minimal compared to the amount required to compete on institutional support for research excellence. A hostile bid for a superb faculty member in the sciences might include from $50,000 to as much as $100,000 in additional salary but $1 million to $5 million in additional research support, as an illustration of these orders of magnitude. Although the additional salary is a recurring expense and the extra research support generally a one-time expense, the cumulative total of special research support for new or retained faculty represents a significant repeating commitment for every competitive research institution. Unionized and civil service faculty salary systems moderate the impact of individual wealth acquisition as a motivator for faculty quality. These systems raise the average cost of faculty salaries above open-market rates and focus most attention on maintaining floors and average increases rather than on significant merit increases. Most universities nonetheless meet competitive offers for their nationally competitive faculty, whatever the bureaucratic structure of pay scales. The marketplaces based on salary enhancement and the required investments in research support combine to increase the cost of maintaining nationally competitive faculty.

The measure of a research university's success is the quantity of high-quality human capital it accumulates.

In the case of the accumulation of high-quality student capital, the model is a bit more complex depending on the institution and its financial structure. In a private research university without substantial public support and high tuition, quality students represent a net expense in most cases. Although tuition and fees are high, at least nominally, the competition for very high-quality students requires a

discount from the sticker price, on average perhaps at the 40% rate. Universities and colleges provide this discount at much higher rates to superb students and at much lower rates, if at all, to merely good students. Almost all elite private research universities subsidize the cost of undergraduate education for their very high-quality students. High-quality students are a loss leader. Colleges and universities recover this investment in the long term, of course, through the donations and contributions of prosperous alumni, but in the short term it costs more to produce a student than the student pays after the discounts. This places a limit on the number of high-quality students a private institution can support. The number varies depending on many individual characteristics of the institutions, but the self-limiting character of the investment in quality students tends to keep private research university enrollments substantially below those of their public counterparts.

In the public sector, the state provides a subsidy for every student. In most states, but not all, the subsidy makes the production of undergraduate education a surplus-generating activity, and at student population sizes less than 40,000, undergraduate education benefits from increased scale. Public institutions teach some courses at sizes substantially larger than in private institutions (200 to 500 or more in an introductory lecture), and they use inexpensive teaching labor to support large numbers of instructional hours in laboratories, discussion sections, and other beginning classes. These economies of scale permit public universities to accumulate a surplus from their undergraduate economy to reinvest in the quality of the students attracted (either by merit scholarships or through the provision of amenities and curricular enhancements such as honors colleges and endless extracurricular activities).

In both public and private sectors, the investments the institution makes in acquiring a high-quality student population and those it makes to recruit and retain superb faculty compete. The return on an investment in student quality always competes against the return on an investment in faculty quality. Although most institutions behave as if these are two separate economic universes, in fact, they both draw on the same institutional dollars. Every dollar saved on instructional costs can support additional research, and every dollar saved on research support can support an instructional enhancement.

The American research university environment varies widely in this relationship between size of undergraduate student population, number of faculty, and amount of research performed. Depending on the possible surplus generated by teaching, universities will have larger or smaller student populations relative to their continuing tenure-track faculty. Universities also have different strategies for teaching, with some institutions expecting a substantial teaching commitment from all faculty and others using temporary, part-time, or graduate student instructors to carry a significant portion of the teaching responsibility. These variations reflect different revenue structures, but for high-quality research universities, the goal is always to have the highest possible student population and the highest-quality research performance by the faculty.

The need for balance reflects not a philosophical position on the nature of higher education but rather the structure of funding that supports high-quality universities. The critical limit on the accumulation of high-quality human capital is revenue, and all research universities seek funding from every possible source. Revenue is the holy grail of all research universities. Students are a source of revenue, whether deferred until graduates provide donations (as in the case of private and increasingly public universities) or current from state subsidies (in the case of public and, to a much lesser extent, some private institutions). Students not only pay costs directly but also mobilize the support of many constituencies who want to see high-quality students in the institutions they support (through legislative action, federal action, private gifts, or corporate donations).

Each revenue provider has somewhat different interests in students, but all respond to the quality of the undergraduate population. Legislators appreciate smart students who graduate on time and reflect an enthusiastic assessment of their educational experience. Federal agencies provide support through financial aid programs for students who attend higher education, making it possible to reduce the cost to the campus of teaching. Private individuals invest in undergraduate programs either because they themselves had a wonderful experience 10 to 40 years ago or they want to be associated with today's high-quality students. Corporations support student programs because they are the ultimate consumers of much of the institutions' student product.

All of these examples respond to quality. Few want to invest in mediocre, unenthusiastic, unhappy students who do not succeed. Smart, creative, and motivated students not only make effective advertisements for the institution but are cheaper to teach, cause fewer management problems, attract the interest of high-quality faculty, and go on to be successful after graduation, continuing the self-reinforcing cycle

for increased student quality. Moreover, the more money generated around the instructional activity, the more becomes available to support the research mission.

The business model of the research enterprise bears some similarities to the student enterprise. Research is a loss leader. It does not pay its own expenses. Research requires a subsidy from university revenue generated through some means other than the research enterprise itself. This is a fundamental element in the research-university business model that often is lost in the conversation about the large revenue stream that comes to universities from research partially sponsored by the federal government, corporations, and foundations. In successful research universities, at least 60% to 70% of the research enterprise relies on subsidies from the institution's non-research revenue. The other 30% to 40% of the total research expenses come from external research funding for direct and indirect costs.

Many expenses fall to the university's account. The institution provides these indirect costs for the space, light, heat, maintenance, and operations associated with every research project funded by an external agency. These costs, audited by the federal government though an elaborate procedure, add about 60% to the direct costs, or the expenses on such things as personnel and other elements required to perform the research. In addition, the rules for defining these indirect costs exclude many expenses assumed by the institutions. Government agencies, recognizing the intense competition for federal research grants, often negotiate discounts from the actual indirect costs and, in addition, require a variety of matching investments from the successful competitors for grants. If an institution can recover even half of the audited indirect costs from the agency funding its research, it considers itself fortunate. At the same time, successful competitors for federal research also have to make special capital investments in laboratory facilities, faculty and staff salaries, graduate student support, and a wide range of other investments to deliver the results partially paid for by the federal grant. These matching contributions, in addition to the unrecovered indirect costs, can add an additional 10% or more to project cost. These transactions clarify the business model of the research university, for the goal of research is obviously not profit or surplus generation but rather the capacity to attract, support, and retain superb research faculty to add to total of high-quality human capital.

The research university's relentless pursuit of additional revenue from every source gathers the financial support required to ensure that first-rank faculty can compete successfully for research grants and projects. The revenue also supports, although at a lower cost but nonetheless significant scale, the humanities and social science faculty whose research results in publications in prestigious journals or university presses.

Smart, creative, and motivated students are cheaper to teach, cause fewer management problems, attract the interest of high-quality faculty, and go on to be successful after graduation.

Our Choice of Indicators of Competitive Success

Over the years, many people have devoted much time and effort to the task of measuring research university performance. These efforts, including this one, tend to focus on particular aspects of university activity such as students, research, public service, or other elements of an institution's activities. Almost all indicators invented for measuring institutions of higher education depend on the quality and reliability of the data collected and the relationship of the indicator to the various dimensions of university activity for their usefulness. Good indicators used for inappropriate purposes are no more helpful than bad indicators. Annual federal research expenditures, for example, is a good indicator of research competitiveness, but it cannot measure the quality of classroom instruction.

The Top American Research Universities collects data that have certain characteristics.

- First, the data need to be reliably collected across the universe of research universities. This often means data collected or validated by sources outside the institutions themselves.
- Second, the data need to either speak directly to indicators of quality or serve as useful surrogates for quality.
- Third, *TheCenter* must publish the data in a form that permits others to use the information in different ways or for different purposes.

TheCenter avoids survey data. While survey data can help universities understand many aspects of their operations, we have not found good survey data focused on research performance. This is particularly true of survey data that attempt to measure research performance based on the opinions of university people. These surveys, while technically sound in many cases, fail because the surveyed population cannot have sufficient knowledge to respond accurately to questions about research quality. No one in the university world has a full understanding of the current research productivity that affects the success of major institutions. Experts may know a lot about theoretical physics or modern poetry and about accounting programs or mechanical engineering, but no one has enough information to pass informed judgment on the research quality of the 180 or so major research institutions in America. They can reflect on the general prestige of institutions, they can give a good sense of the public name recognition of various institutions, and they can reflect the accumulated public relations success of colleges and universities. Under the best of circumstances, reputation reflects both current and past success; it may rest on the work of famous scholars long departed, on the fame associated with celebrities, or on the name recognition associated with intercollegiate athletics.

Good indicators used for inappropriate purposes are no more helpful than bad indicators.

Whatever the source of the name recognition that translates into reputation, and whatever the importance of name recognition in the competition for quality faculty and students, improvement and competition in the end turn on actual research by and acquisition of actual faculty and students, and not on the variable reflections of the glory associated with different name brands. Often, the reputation of institutions matches their current performance; but sometimes it does not. While reputation may match performance among the best institutions that excel in everything, it is much less a reliable indicator among universities with below-top-level performance. To track improvement among these colleges and universities, more robust and reliable indicators that apply to the great and near-great are required. *The Top American Research Universities* offers data on an annual basis that can help institutions improve. We use data that reflect performance rather than surveyed opinions about performance.

Equally problematic are data that attempt to measure student satisfaction or student engagement. These data may prove helpful for institutions seeking to improve student retention and recruitment. Their value in measuring quality of instruction and quality of the students themselves is doubtful. Clear linkages between what students learn and how well they enjoyed or engaged the institution during the course of learning remain elusive. We can establish that students did indeed engage the campus, that they do enjoy their experience, that they did find the environment supportive and creative, and so on. It is much more difficult to create a clear link between what students learn about chemistry and history, or example, and the experiential characteristics of college life. With the advent of distance education and other forms of educational delivery, these discussions of student experience become even more difficult to interpret across the wide range of institutional types we classify as research universities.

To some extent, from our perspective, the universe of possible data to use to explore research university performance falls into two large categories.

- At the top level, clear quantitative indicators of competitiveness help classify institutions by their competitive success against similar institutions.
- At a second level, data about student satisfaction, faculty satisfaction, and other elements of the processes of university life can help individual institutions identify the strategies and tactics that, when implemented, will improve the competitiveness reflected by the top-level measures.

This is the black box approach to institutional success. It imagines that the university is a black box whose inner workings are not visible from the outside but whose work delivers products to an open, highly competitive marketplace. By measuring indicators of the competitiveness of these products, we can infer whether the mostly invisible processes inside the black box functioned effectively. If they did not, then the institution could not be competitive. This perspective allows us to recognize that individual institutions may use different methods to arrive at similar, highly competitive results, and it allows us to focus on results rather than processes.

The value of this approach lies in, among other things, the ability to sidestep the academic fascination with process. Universities, like most highly structured bureaucracies, spend a great deal of time on the process for management rather than on the purpose or result of management. This universal tendency gains

even greater prominence because of the highly fragmented nature of the academic guilds and their handicraft production methods. Every management decision requires a process to capture the competing interests of the various guilds, and in university environments, a focus on results and external competitiveness can contain these process issues within some reasonable bounds.

The top-level indicators, chosen for this publication, fall into several groups—each speaking to a key element in research university competitiveness. The first group of measures speaks directly to research productivity: federal research expenditures and total research expenditures. For federal research expenditures, we report the total spent from federal research funds during the most recent fiscal year (usually the data lag a year and a half). The value of this indicator is that the federal government distributes most of its funds on a peer-reviewed, merit basis. While some significant projects arrive at university campuses from politically inspired earmarks, and other direct appropriations for research, most federal research investment comes through agencies such as the NSF, NIH, Department of Energy, and others that use peer-review panels to select projects for funding. Through this mechanism, the dollars expended serve as a reasonable indicator of a university's total competitiveness relative to other institutions seeking these federal funds.

Research expenditures is an aggregate measure. It measures whether each institution's total faculty effort produces a greater share of federally funded research than the faculty of another institution. This indicator is not a direct measure of research quality but rather an indirect measure. When we use this indicator, we assume that the total amount of federal dollars accurately reflects the competitiveness of the faculty. We do not assume, for example, that a grant of $5 million reflects higher merit on the part of the faculty involved than a grant of $1 million. We simply report that the most competitive research universities capture the largest amounts of federal funding.

This measure also reflects the composition of the research profile of the institution. An institution with a medical school, an engineering school, and a high-energy physics program may have very substantial amounts of annual federal research expenses that reflect the expensive nature of the projects in these fields. In contrast, another institution may pursue theoretical physics, have no medical school, support a strong education program, and attract an outstanding faculty in the humanities and social science and in the fine and performing arts. This institution likely will have a lower annual federal research expenses even if it has the same number of faculty who have the same level of national quality because its research emphasis is in fields with smaller funding requirements. Do we conclude that the second institution has less quality than the first? No. We conclude that the second institution is less competitive in the pursuit of federally funded research than the first. The priorities of the federal government can also skew the measure. When NIH funding is greater and grows faster than the funding of other federal agencies (such as NSF, for example), universities with medical schools and strong life sciences research programs benefit. Understanding the meaning of these indicators helps institutions effectively use the comparative measures without inferring meaning that the indicators do not measure.

A second measure of research productivity appears in the indicator the NSF defines as total research. Total research funding includes not only the annual expenditures from federal sources but also those from state, corporate, and entitlement programs. These can include state and federal entitlement grants to public land grant colleges, corporate funding of research, and a wide range of other research support. As the tables demonstrate, all major research universities compete for this non-peer-reviewed funding in support of research. Some of this funding comes to an institution because of geographic location, political connections, commercial relationships with corporations, and similar relationships, rather than through direct competition based on quality. Nonetheless, the research activity reflected by these expenditures enhances the strength and competitiveness of the institutions, which all compete, if not always based on peer-reviewed merit, for these funds. Total research adds an important dimension to our understanding of research university competition.

The top-level indicators, chosen for this publication, fall into several groups—each speaking to a key element in research university competitiveness.

The next group of indicators focuses on the distinction of the faculty. Although research volume is by far the clearest indicator of university research competitiveness, it fails to capture the quality of the individual faculty members. In our model, the individual faculty provide the drive and leadership to

compete for research excellence. The dollar totals, while a critical indicator of faculty quality, lack the specificity of individual faculty recognition. *The Top American Research Universities* includes two measures of faculty distinction unrelated to dollars spent: National Academy Memberships and Faculty Awards.

An indicator of faculty competitiveness comes from election to prestigious national academies and the high-level national awards faculty win in competition with their colleagues. National Academy Memberships often reflect a lifetime of achievement; most national-level faculty awards reflect recent accomplishments. In addition, the process of selection for National Academies is substantially different from that used for faculty awards. Even more importantly here, these indicators provide a way to capture the competitiveness of faculty not in the sciences or other federally funded areas of research. Humanities and the fine arts, for example, appear reflected in the list of faculty awards included in these indicators.

A third group provides a perspective on undergraduate quality. In the data for 2000-2003, we report the SAT ranges for research universities as a rough indicator of the competitiveness in attracting high-quality students. This indicator serves primarily because the public pays so much public attention to this indicator rather than because it is a good measure of student quality. Other indicators predict college success better than the SAT, and of course standardized tests measure only one dimension of student abilities. Nonetheless, the intense public focus on this measure made it a useful indicator to test whether first-rank research universities also attract the most sought-after undergraduate students.

Another indicator concerns graduate students—specifically the production of doctorates. A major research university has as one of its purposes the management of many doctoral students and the production of completed doctorates. To capture this dimension of research university performance, we include the number of doctorates granted. As a further indication of advanced study, we include the number of postdoctoral appointments at each institution. Major research universities, as a function of their research programs, compete for the best graduate students to become doctoral candidates and compete for the best postdocs to support and expand their research programs and enhance their competitiveness.

The final group has two indicators that serve as imperfect indicators of disposable institutional wealth. This is a complicated and unsatisfactorily resolved issue. Universities have different financial resources available to invest in their work. They invest in general operations and they invest in the enhancement of quality. The size of a university's budget is a poor indicator of the choices the university makes in supporting high-quality research competitiveness. If a university has a large undergraduate population, its budget also will be large but a significant percentage goes to pay the cost of delivering the undergraduate curriculum to all the students. Similarly, if an institution has a smaller budget but also a much smaller student population, then it may invest more in support of research competition than the larger university. Disposable income is the income not committed to the generic operation of the institution and its undergraduate program. Disposable income can enhance the institution's undergraduate competitiveness or subsidize its research competition. In most places, disposable income covers both these goals in varying combinations and patterns.

We made an effort to estimate the disposable resources of research universities in the 2002 edition of *The Top American Research Universities*, and we learned much about the finances and reported data on finances of these institutions. Unfortunately, no reliable data exist that would allow us to collect and report a clear indicator of institutional wealth. As an incomplete surrogate, we report the size of a university's endowment and the amount of its annual private gifts.

Endowment represents the accumulated savings of the permanent gifts to the university by its alumni and friends over the lifetime of the institution. These endowments range from about $14 million to about $19 billion in 2003 among universities with more than $20 million in federal research expenditures. The income from these endowments represents a constant and steady source of income available for investment (limited by endowment restrictions, of course) in quality teaching and research. If in the past public universities might have been exempt from the need to raise private dollars, this has not been the case for a generation or more. Every major public research university has a substantial endowment and a large annual giving program, designed to provide the income to support quality competition for students and faculty. While private institutions rely mostly on alumni and friends, public institutions not only seek donations from those traditional sources but in some states enjoy the benefit of state matching programs that donate public funds to the endowment on a public to private matching basis of 1 to 1 or some lesser fraction ($0.50 per $1 private dollar, for example).

Where endowment reflects past support, annual giving, some of which ends up in endowment or capital expenditures and some appears as direct support for operations, serves as a current reflection of an institution's competitiveness in seeking private support for its mission. Every research university operates a major fundraising enterprise whose purpose is the acquisition of these funds to permit greater competitiveness for quality students and faculty, and increased national presence.

These nine measures, then, have served as our reference points for attempting to explore the competitiveness of America's top research universities: Federal and Total Research Expenditures, National Academy Memberships and National Faculty Awards, Undergraduate SAT Scores, Doctorates Awarded and Postdoctorates Supported, and Endowment and Annual Giving.

Definitional Issues

Before turning to the classification system, we need to review the universe included within *The Top American Research Universities*. While the United States has about 2,400 accredited institutions of higher education that award a baccalaureate degree, only 182 of them qualify as top research universities under our definition for this report. The cutoff we chose at the beginning of this project, and have maintained for consistency, is $20 million in annual federal research expenditures. This number identifies institutions with a significant commitment to the research competition. This universe of institutions controls approximately 94% of all federal expenditures for university research and includes the majority of the faculty guild members who define the criteria for faculty research quality. The competition takes place primarily between the faculty in these institutions, and the support that makes that competition possible comes primarily from the 182 institutions reported here, which had more than $20 million in federal research expenditures in fiscal year 2002.

In general, the bottom boundary of $20 million is a boundary of convenience, for it could be $30 million or $15 million without much impact on the results. The nature of the competition in which all research universities engage is determined primarily by those universities at the top of the distribution—those spending perhaps more than $100 million from federal research each year. Those universities have the scale to invest in their faculty, invest in the recruitment of their students, invest in the physical plant and other infrastructure needed to compete for research grants, and provide the institutional matching funds so many competitive projects require. . When institutions at lower level of performance send their faculty to compete for federal grants from the NIH or the NSF, they must also send them with institutional support equivalent to what one of the top tier of institutions can muster behind their faculty member's project. This drives the cost of the competition upward. The top institutions set the entry barrier for competition in any field. A top-performing institution can support faculty at competitive levels in a wide range of fields, disciplines, and programs. A university at a lower level of performance may be capable of supporting competitive faculty in only a few fields, disciplines, or programs. The behavior of the top 50 or so competitors drives marketplace competition among research universities.

If we have a decision rule for including institutions within the purview of this review of competitiveness, we also have to define what we mean by "institution." American universities, especially public universities, exist in a bewildering variety of institutional constructs, bureaucratic arrangements, public organizational structures, and the like. For those interested in this structure, we reviewed these organizational patterns in our 2002 report. . As mentioned in the introduction, for various political and managerial reasons, many multi-campus public universities prefer to present themselves to the public as if they were one university. We believe that while these formulations serve important political and organizational purposes, they do not help us understand research university competition and performance. The primary actors in driving research university performance are the faculty, and because the faculty are almost universally associated with a particular campus locality, and because the resources that support most faculty competitive success come through campus-based resources or decisions, we focus on campus-defined institutions. The unit of analysis, for example, is not the University of California, but the campuses of Berkeley, UCLA, UC San Diego, UC Davis, and so on. We compare the performance of Indiana-Bloomington and Massachusetts-Amherst; we compare Illinois-Urbana Champaign and Michigan-Ann Arbor. Some university systems resent this distinction, believing that this study should preserve their formulation of a multi-campus single university. We do not agree because we believe that the resource base and competitive drive that make research competition successful come from campus-based faculty.

In some cases, this produces complexities. For example, the University of Michigan has its medical enterprise and all research activity associated with it on its Ann Arbor campus, while the Massachusetts campuses of Amherst and Worcester operate independently and so appear separately in our report, even though both belong to the University of Massachusetts system. In most cases, these distinctions are relatively easy to make. Another variation occurs with Indiana University, whose Bloomington campus has a complete undergraduate and graduate program and whose Indianapolis campus operated jointly by Indiana and Purdue also has a complete undergraduate and graduate program as well as a medical school. In addition, each campus has its own independent law school. We report research separately for each campus even though both belong within the Indiana University administrative structure. The criteria we use to identify a campus are relatively simple. We look to see whether a campus reports its research data independently, operates with a relatively autonomous academic administrative structure, admits undergraduate students separately, has distinct academic programs of the same type, and like criteria. If many of these elements exist, we take the campus as the entity about which we report the data. While not all of our colleagues agree with our criteria for this study, the loss is minimal because we provide all the data we use in a format that permits every institution to aggregate the data to construct whatever analytical categories it believes most useful for its purposes. This report presents the data in a form most useful for our purposes.

As an illustration of the difficulty of using systems as the unit of analysis, the following tables show systems inserted in the federal research expenditures ranking as if they were single institutions. For this demonstration we combined those campuses of state systems that appear independently within *The Top American Research Universities* with more than $20 million in federal research. A few systems have campuses with some federal research expenditures that do not reach this level of competitiveness, but we did not include those for the purposes of this demonstration.

Note that the research campuses of five public systems together perform federal research at levels that place them among the top 10 single-campus institutions. Only the University of California system exceeds the research productivity of Johns Hopkins, and only the University of Texas system exceeds all other campuses. Other systems performing within the top 10 of individual campuses are the University of Illinois, ranked about seventh, and the Maryland and Colorado systems, ranked about ninth.

Three systems perform at levels that match the federal research expenditures of the second 10 campuses: SUNY, Penn State, and the University of Alabama systems.

The Utah State system appears at 22 and the Texas A&M system at 32 among individual campuses ranked from 21 to 40.

Ten other systems complete this distribution, with the University of Nevada system having the smallest aggregated federal research expenditures ranking at about 102 among these campuses.

The complete table showing all the measures (except the SAT, which cannot be combined from the campus data for system totals) along with national and control rankings for systems and individual institutions is in the Appendix.

An inspection of this table shows that the totals for systems reflect primarily the political and bureaucratic arrangements of public research campuses rather than any performance criteria. A different political organization of the University of California system—we might imagine a Northern University of California and a Southern University of California—would produce dramatically different rankings without representing any change in the underlying productivity of campuses. The number of campuses with more than $20 million in federal research expenditures in any one system varies from a low of 2 in many states to a high of 9 for the University of California system. Note that many of these systems have many more campuses, but for this comparison we included only those with more than $20 million in federal research expenditures. Similarly, had we done this table six or seven years ago, we would have had a State University System of Florida in the rankings. Today, each campus in that state operates as an independent university with its own board. Since the goal of our work is to focus on the quality and productivity of research universities, it is campus performance that matters most, not the political alignments of campuses—structures that change quickly.

Control	Institutions with More Than $20 Million in Federal Research Expenditures and Public Multi-Campus Systems Ranked 1-20 out of 40 (Systems include only campuses at $20 Million in Federal Research Expenditures)	2002 *** Federal Research x $1000	Federal Research National Rank
	University of California system	1,706,603	
Private	Johns Hopkins University	1,022,510	1
	University of Texas system	752,586	
Public	University of Washington - Seattle	487,059	2
Public	University of Michigan - Ann Arbor	444,255	3
Private	Stanford University	426,620	4
Private	University of Pennsylvania	397,587	5
Public	University of California - Los Angeles	366,762	6
Public	University of California - San Diego	359,383	7
	University of Illinois system	357,506	
Private	Columbia University	356,749	8
Public	University of Wisconsin - Madison	345,003	9
	University of Maryland system	340,488	
	University of Colorado system	337,061	
Private	Harvard University	336,607	10
Private	Massachusetts Institute of Technology	330,409	11
Public	University of California - San Francisco	327,393	12
Public	University of Pittsburgh - Pittsburgh	306,913	13
Private	Washington University in St. Louis	303,441	14
	State University of New York system	302,956	
Public	University of Minnesota - Twin Cities	295,301	15
	Pennsylvania State University system	284,706	
	University of Alabama system	278,781	
Private	Yale University	274,304	16
Private	Cornell University	270,578	17
Private	University of Southern California	266,645	18
Private	Duke University	261,356	19
Private	Baylor College of Medicine	259,475	20

TheCenter's Categories

Many of the critics of popular rankings focus not only on the defective methodology that characterizes these publications but also on the assumption that a rank ordering of universities displays meaningful differences between the institutions. Much attention, for example, gravitates toward small changes in ranking when No. 1 in last year's ranking is No. 2 in this year's. Even if the methodology that produces these rankings were reliable and sound, which it is not, differences between similar and closely ranked institutions are usually insignificant, and small changes on an annual basis rarely reflect underlying improvement or decline in relative institutional effectiveness. Universities are indeed different. They have different levels of performance, and their relative performance varies in comparison with the performance of their competitors. Universities' rank order on various indicators does change from year to year, but these changes can reflect a decline in nearby institutions rather than an improvement in the campus with an improved rank. Significant changes in university performance tend to take time, and most institutions should respond not to annual changes in relative performance but rather to trends in relative performance.

This is an important consideration because focusing on short-term variations in suspect rankings leads trustees, parents, and others to imagine that university quality itself changes rapidly. This is false, primarily because the key element in institutional quality comes from the faculty and the faculty as a group changes relatively slowly. Faculty turnover is low, and most faculty have long spans of employment at their institution. While the media notice any rapid movement of superstars from one institution to another,

Control	Institutions with More Than $20 Million in Federal Research Expenditures and Public Multi-Campus Systems Ranked 21-40 out of 40 (Systems include only campuses at $20 Million in Federal Research Expenditures)	2002 *** Federal Research x $1000	Federal Research National Rank
Public	Pennsylvania State University - University Park	256,235	21
Public	University of North Carolina - Chapel Hill	254,571	22
	Utah State system	222,018	
Public	University of Texas - Austin	219,158	23
Public	University of California - Berkeley	217,297	24
Public	University of Alabama - Birmingham	216,221	25
Public	University of Illinois - Urbana-Champaign	214,323	26
Public	University of Arizona	211,772	27
Private	California Institute of Technology	199,944	28
Private	University of Rochester	195,298	29
Public	University of Maryland - College Park	194,095	30
Public	University of Colorado - Boulder	190,661	31
Private	Emory University	186,083	32
	Texas A&M University system	185,905	
Private	University of Chicago	183,830	33
Private	Case Western Reserve University	181,888	34
Public	University of Iowa	180,743	35
Private	Northwestern University	178,607	36
Public	Ohio State University - Columbus	177,883	37
Public	University of California - Davis	176,644	38
Private	Vanderbilt University	172,858	39
Private	Boston University	171,438	40

these changes affect a very small number of faculty. The impact of such defections and acquisitions on the fundamental competitive quality of the institution is likely small unless accompanied by a sustained reduction of investment in the areas they represent or a decline in the quality of the replacements hired.

Year-to-year changes also can be deceptive because of spot changes in the research funding marketplace, temporary bursts of enthusiasm for particular institutional products as a result of a major capital gift, a football or basketball championship, and other one-time events. These things can produce a spike in some indicator, producing what appears to be a change in the relative position of an institution in a ranking, but the actual sustained change in institutional quality may be quite small.

At the same time, annual reports of relative performance on various indicators serve a useful purpose for university people focused on improvement and competitiveness. Changes reflected in these indicators require careful examination by each institution to determine whether what they see reflects a temporary spike in relative performance or an indication of a trend to be reversed or enhanced. Single value rankings, that combine and weight many different elements of university performance, obscure real performance elements and render the resulting ranked list relatively useless for understanding the relative strength of comparable institutions.

At *TheCenter*, considering these issues, we decided to present the best data possible on research universities and then group the institutions into categories defined by similar levels of competitiveness on the indicators for which we could get good data. While this does indeed rank the institutions, it does so in a way that forces the observer to recognize both the strength and weakness of the data as well as the validity of the groups as a device for categorizing institutional competitiveness.

The methodology is simple. We ranked the universities in our set of research institutions on the nine indicators. We then put institutions performing among the top 25 on all the indicators in the first group, the institutions performing among the top 25 on all but one of the indicators in the second group, and so on. This process follows from the observation that America's best research universities tend to perform at top levels on all dimensions. The most competitive institutions compete at the top levels in

federal research, total research, and student quality. They produce the most doctorates, they support the most postdocs, they raise the most money from their alumni and friends, and they run the largest annual private giving programs. They have the most faculty in the national academies, and their faculty win the most prestigious awards. We also do this grouping in two ways—first, taking all research universities, public or private, and grouping them according to their relative performance. and second, separating the universities by their control or governance (public or private) and then grouping the publics by their competitive success among public institutions and the privates by their competitive success among private institutions.

This method focuses attention on the competition that drives public and private research university success and challenges the observer to understand the marketplace within which they compete.

Change Over Time

TheCenter's methodology allows a comparison of change over time in valid and reliable objective indicators of success. Unlike popular magazine rankings, which change each year much more quickly than universities actually change, *TheCenter's* rankings give a good measure of how likely change actually is for universities. Even *TheCenter's* data, however, are susceptible to misinterpretation because universities can change their reporting methods or reorganize their institutions in ways that produce changes in the data that may not reflect actual changes in performance. Careful review of major shifts in research performance by individual institutions can separate the real changes from artifacts of changes in reporting or organization.

The Top American Research University rankings are perhaps more useful for illustrating the competition that defines research success than for displaying the rank order itself. For example, our analysis of the federal research data demonstrated that the competition among institutions over time produces a few dramatic leaps forward and some steady change over time. This is significant because often trustees, alumni, and other observers imagine that a reasonable expectation is for a university to rise into the top 10 or some similar number in the space of a few years by simply doing things better or more effectively. If the institution is already No. 12 in its competitiveness, perhaps such an expectation is reasonable. If an institution is competing among other institutions that rank in the 20s or 30s, a move into the top 10 in 10 years is probably beyond reach. This is because the distance in performance between the top institutions and the middle-to-bottom institutions in this marketplace is very large.

In the important federal research funding competition, which is the best indicator of competitive faculty quality, the median annual federal research expenditure of a top-10 research university is about $382.2 million a year. The median for the 10 research universities ranked from 41 to 50 nationally on federal research expenditures is about $155.3 million. A median institution in this group would need to double its annual federal research expenditures to reach the median of the top 10. If we look at only the top 25 institutions, the median of federal research expenditures in this elite group is $317.2 million, with a high at Johns Hopkins of $1,022.5 million and a low at the University of Alabama–Birmingham of $216.2 million. UA-Birmingham would have to increase its federal research expenditures by a factor of about five to match Hopkins. To meet even the median of the group, it would need an increase of $100 million per year. This is a formidable challenge for even a top-25 research university.

Because universities change their reporting methods or reorganize their institution's changes in data may not reflect actual changes in performance.

The second group of 25 institutions has a much lower median of $176.6 million. For the 50th-ranked institution in federal research, the University of Utah with $142.6 million, to reach the median of the institutions ranked in the second 25, it would need to increase its federal research expenditures by about $24 million per year, or 17%.

These two examples illustrate an important characteristic of the university federal research marketplace. At the top, the difference between university performances tends to be much greater than at lower levels. As we go down the ranking on federal research, institutional performance clusters closer and closer, with small differences separating an institution from the ones above and below. The spread between the bottom of the top 25 and median of the top 25 is about $100 million. The spread between the bottom of the second 25 and the median is about $24 million; but the spread between the last institution in the over-$20 million ranking (at $20.0 million) and the

median of the last 25 institutions in the over-$20 million group (at $22.8 million) is only about $2.8 million.

This pattern helps explain the small amount of significant change in ranking among the top institutions over the five years of *TheCenter's* publications and the larger amount of movement in rank among the institutions lower down in the research productivity ranking. For example, if we look at the top 10 institutions in our first publication in 2000 that used federal research data from 1998, only one (MIT) fell out of the top 10 by 2002 to be replaced by Columbia, a university not in the top 10 in 1998. A similar amount of modest change occurs among the top 25. Within this group in 1998, only two institutions fell out of this category in the 2002 data (University of Illinois-Urbana-Champaign and Caltech), replaced by two institutions not in the top 25 in 1998 (Penn State and Baylor College of Medicine). These examples demonstrate that the large amounts of federal research required to participate in the top categories of university competition create a barrier for new entrants because the characteristics of success are self-perpetuating. Very successful institutions have the characteristics that continue to make them major competitors in this marketplace year after year.

If we look nearer the middle of the distribution of universities by their federal research expenditures and chart the changes over the five years of our reports, we see considerably more change in the rankings, as we would expect. For example, among universities ranked nationally from 101 to 125 on federal research expenditures, nine institutions included in this group in 1998 disappeared from this section of the rankings by 2002 and another nine institutions took their place. However, the movement into and out of this group is quite varied.

Five institutions moved from a lower ranking in 1998 into the 121-125 group in 2002:

Institution	Fed Research Ranking 1998	Fed Research Ranking 2002	Change in Fed Research Rank
Kansas State	130	121	+9
Auburn	128	122	+6
West Virginia	134	113	+11
University of New Hampshire-Durham	133	112	+21
University of Connecticut-Storrs	143	110	+33

Four institutions lost ground and moved from a higher ranking in 1998 into the 121-125 group in 2002:

Institution	Fed Research Ranking 1998	Fed Research Ranking 2002	Change in Fed Research Rank
University of Massachusetts-Amherst	100	106	-6
Washington State University-Pullman	96	105	-9
George Washington University	94	103	-9
Tulane University	86	101	-15

Another four institutions declined in rank from their 1998 location in this group to fall below 125 in the 2002 ranking:

Institution	Fed Research Ranking 1998	Fed Research Ranking 2002	Change in Fed Research Rank
Rice University	110	128	-18
UC Santa Cruz	119	139	-20
Syracuse University	120	140	-20
Brandeis University	125	152	-27

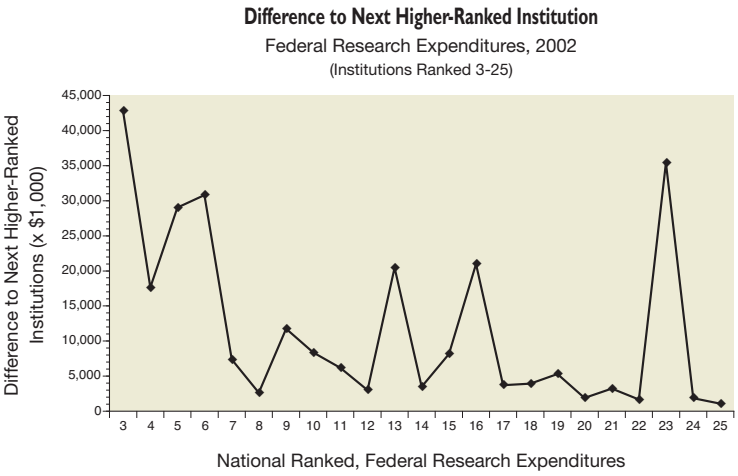
Finally, five institutions moved out of the 121-125 category in 1998 into a higher ranking for 2002:

Institution	Fed Research Ranking 1998	Fed Research Ranking 2002	Change in Fed Research Rank
University of Tennessee – Knoxville	104	74	+30
Mississippi State University	102	89	+13
University of South Florida	109	77	+32
Medical University of South Carolina	107	91	+16
University of Alaska – Fairbanks	115	99	+16

These examples reflect the greater mobility at the lower ranks, where the difference between one university and another can be quite small and a few successful grants can jump an institution many ranks while a few lost projects can drop an institution out of its category.

Rankings, however, have another difficulty. The distance between any two contiguous institutions in any one year can vary dramatically, so changes that reflect one or two ranks may represent either a significant change in performance or a relatively minor change in performance. For example, if we take the top 25 and calculate the distance that separates each institution from the one above it, the median separation is $6.8 million. However, leaving aside the difference between No. 2 and Johns Hopkins (which is $535.5 million), the maximum distance is $42.8 million and the minimum distance is $1.1 million. Even in this rarefied atmosphere at the top of the ranking charts, the range is dramatic and very

unevenly distributed. The following graph illustrates the difference between each institution and the one above it for the institutions ranked between 3 and 25 on federal research in 2002.



All of this explains why *TheCenter* groups institutions rather than focuses on each institution's precise rank order. Even this method has its difficulties because the differences between institutions on each side of a group boundary may not be particularly large. Nonetheless, a method that groups universities and considers their performance roughly comparable is better than simple ranking that can imply an evenly spaced hierarchy of performance.

When we review these data in search of an understanding of the competitive marketplace of research universities, we pay special attention to other characteristics of the data. Some universities have research-intensive medical schools; some institutions operate as stand-alone medical centers, and some research-intensive universities have no medical school. Over the last five years at least, the federally funded research opportunities available in the biological and medically related fields have grown much faster than have those in the physical sciences. Some of the significant changes observed in the last five years reflect the competitive advantage of institutions with research-intensive medical schools. However, not all medical schools have a major research mission, but when they do, and when the medical research faculty are of high quality and research oriented, the biological sciences emphasis likely provides a significant advantage in the competition as seen in our 2001 report.

For example, among the top 25 institutions in federal research expenditures, all but two have medical schools included in their totals. However, having a medical school is no guarantee, even in this top category, of meeting the competition successfully. As the table on the following page indicates, 11 of these top 25 fell by at least one rank over the five years included here.

Illustrating the remarkable competitiveness of this marketplace, note that even institutions that grew by more than 30%, or an average of more than 6% a year, lost rank. In research university competition, growth alone is not a sufficient indicator of comparative success. Universities must increase their research productivity by more than those universities around them increase or lose position within the rankings. Similar results appear farther down the ranking, as the table on page 25 illustrates, for universities ranked between 75 and 100 on federal research in 2002.

Note that, as mentioned above, the amount of positive change in federal research required to produce an improvement in rank is considerably less than in the top 25. The percentage improvement to produce a change in rank is also larger in most cases. Almost all universities in the top 100 of federal research expenditure show an improvement with the exception of North Carolina State, which reported fewer federal research expenditures in 2002 than in 1998. Growth alone does not keep a university even with the competition and, as is clear in these data, the competition is intense and demanding.

Similar exercises using the data published on *TheCenter's* Web site can serve to highlight the competitive marketplace for any subset of institutions included within *The Top American Research Universities*. While we have emphasized the federal research expenditures in these illustrations, similar analysis will demonstrate the competitiveness in the area of total research expenditures, faculty awards, and the other indicators collected and published by *TheCenter*.

Another perspective on the complexity of identifying and measuring universities' national competitive performance appears when we examine the change in the number of national awards won by faculty. The list of these awards is available in the Source Notes section of this report, and we have collected this information systematically over the five years. However, faculty awards reflect a somewhat less orderly universe than we see in research expenditure data. The number of faculty with awards varies over time as universities hire new faculty, others retire or leave, the award programs have more or less funding for awards, and the award committees look for different qualities

Change in Federal Research Expenditures 1998-2002, Top 25 in 2002					
Institution	Rank Change	$ Change x 1,000	% Change	Rank	Medical School *
Baylor College of Medicine	20	148,865	134.6	20	*
University of Pittsburgh – Pittsburgh	10	138,402	82.1	13	*
Pennsylvania State University – University Park	5	92,314	56.3	21	
University of California – Los Angeles	4	132,757	56.7	6	*
Columbia University	3	127,026	55.3	8	*
University of Pennsylvania	3	149,673	60.4	5	*
Washington University in St. Louis	3	116,268	62.1	14	*
University of Texas – Austin	2	54,076	32.8	23	
University of Michigan – Ann Arbor	1	132,805	42.6	3	*
University of Washington – Seattle	1	144,768	42.3	2	*
Duke University	0	88,824	51.5	19	*
Johns Hopkins University	0	269,527	35.8	1	*
University of California – San Francisco	0	107,763	49.1	12	*
University of Wisconsin – Madison	0	104,490	43.4	9	*
University of Alabama – Birmingham	-1	49,391	29.6	25	*
University of California – San Diego	-1	96,280	36.6	7	*
University of Minnesota – Twin Cities	-1	90,560	44.2	15	*
University of North Carolina -– Chapel Hill	-1	83,066	48.4	22	*
Cornell University	-2	66,391	32.5	17	
Stanford University	-2	84,194	24.6	4	*
University of Southern California	-2	76,098	39.9	18	*
Harvard University	-3	84,731	33.6	10	*
Yale University	-3	69,258	33.8	16	*
University of California – Berkeley	-4	45,550	26.5	24	*
Massachusetts Institute of Technology	-6	19,668	6.3	11	

at different times. Moreover, the number of awards we capture also varies by year: in 1999 we identified 2,161 faculty with awards that met our criteria, and in 2003 this number had declined to 1,877. This is a small number of awards for the 182 institutions included in our group. The first 50 institutions in the list, in both 1999 and 2003, capture more than 66% of these awards. In addition, ranking data are even less useful here than in other contexts because many universities have the same number of faculty members with awards and therefore have the same rank number. A change in one faculty member with an award can move an institution some distance on the rank scale, as the chart on page 26 demonstrates for the first 10 in our list. The range of faculty awards in 2003 for all universities in our more than $20 million list ranges from zero at the bottom of the list to Harvard's 54 faculty awards. Even so, among the top 10, seven have fewer awards and only three have more awards in 2003. Another way of looking at these data is to see what percentage of the total awards identified corresponds to groups of institutions or individual institutions. In this case, while the top 50 capture more than 66% of the awards, the 110 institutions with 10 or fewer awards (they are 61% of all universities in the list) have only 5.9% of the awards. Indeed, 38% of the awards belong to the top 20 institutions.

Even among the top 20, we can see considerable change. Four institutions in 2003 replaced five institutions in the top 20 in 1999 (the ties in award numbers account for the difference between five and four).

This view of university performance data over time highlights one of the fundamental purposes of *The Top American Research Universities* project. By providing a standard, stable, and verifiable set of indicators over time, universities interested in their performance within the competitive marketplace of research institutions can track how well they are doing

Change in Federal Research Expenditures 1998-2002, Rank 75-100 in 2002				
Institution	National Rank Change	$ Change x1,000	% Change	National Rank in 2002
University of South Florida	32	48,178	134.1	77
Dartmouth College	20	42,202	93.7	75
Medical University of South Carolina	16	39,330	107.8	91
University of Alaska – Fairbanks	16	34,664	110.0	99
Mississippi State University	13	35,517	84.6	89
University of Texas Health Science Center – San Antonio	9	31,807	61.2	78
Medical College of Wisconsin	9	32,410	73.9	90
Thomas Jefferson University	5	27,489	53.1	83
University of Texas Medical Branch – Galveston	5	29,512	60.7	86
University of Missouri – Columbia	5	32,294	71.1	88
Utah State University	1	24,490	44.6	82
Brown University	0	23,803	53.6	97
Rockefeller University	0	23,714	54.1	98
Indiana University–Purdue University – Indianapolis	-1	22,151	38.5	81
University of Georgia	-3	23,374	42.7	87
Iowa State University	-5	20,223	39.5	94
Florida State University	-5	20,005	39.7	95
Rutgers NJ – New Brunswick	-6	19,024	30.6	80
Virginia Commonwealth University	-8	16,861	35.0	100
Woods Hole Oceanographic Institution	-12	13,693	21.1	84
New Mexico State University – Las Cruces	-14	13,727	24.3	96
University of California – Santa Barbara	-15	9,690	14.1	85
Tufts University	-18	12,069	19.7	93
Georgetown University	-21	2,286	2.7	76
Virginia Polytechnic Institute and State University	-22	242	0.3	79
North Carolina State University	-29	(4,329)	-5.4	92

relative to their counterparts and relative to the marketplace. They can see where their institution has been and where its recent performance places it. The data do not identify the internal activities, incentives, organizational changes, and revenue opportunities that explain the changes observed, but the data force institutions to confront their relative achievements among their counterparts whose faculty compete in the same markets.

Different institutions at different points in their development or with different strategies for competitive success will use these data in different ways. They will design strategies for improvement or choose to focus on activities unrelated to research as their mission and trustees dictate. In making these decisions, *TheCenter's* data provide them with a reliable and comparative framework to understand the competition they face in the research university marketplace.

Faculty Numbers

Even though the most important element in research university success comes from the faculty, the data on individual faculty performance prove extremely difficult to acquire. Ideally, we could count a university's total number of research faculty. Then we could calculate an index of faculty research productivity. Such a procedure would allow us to compare the competitiveness of the faculty of each institution rather than the aggregate competitiveness of the institution. In such an analysis, we might find that the individual research faculty at a small institution are more effective and competitive per person than the research faculty at a large institution, even if the aggregate competitiveness of the large institution exceeds that of the smaller university. Various researchers have attempted this form of analysis, but the results have been less useful than anticipated.

The reason for the difficulty is simple. We do not have an accurate, standard method for counting the number of research faculty at universities. The

Institutions In and Out of Top 20 in Faculty Awards, 1999-2003

Top 20 in 2003 but not in 1999

Institution	1999 Awards	2003 Awards	Change in Number of Awards
Cornell	27	32	+5
Northwestern	25	30	+5
Penn State	23	29	+6
Princeton	26	27	+1

Top 20 in 1999 but not in 2003

Institution	1999 Awards	2003 Awards	Change in Number of Awards
MIT	42	23	-19
University of Pennsylvania	50	23	-27
University of Colorado–Boulder	28	19	-9
University of Minnesota	28	14	-14
University of Texas–SW Medical Center	28	13	-15

American research university's business model requires that most individual faculty both teach and perform competitive research within the frame of their full-time employment. The institutions rely on the revenue from teaching in many cases to support the costs of faculty research time not covered by grants and contracts. We do not have reliable definitions for collecting data that would permit us to know how many research equivalent faculty a university might have.

Faculty assignments and similar information surely exist, but they rarely provide either a standard or even a reasonable basis for determining the research commitment of faculty against which to measure their productivity on research. Most faculty assignments respond to local political, union, civil service, or other negotiated definitions of workload, and universities often apply these effort assignments without clear linkage to the actual work of the faculty. Even the term "faculty" has multiple and variable definitions by institution in response to local political, traditional, union, or civil service negotiated agreements. Librarians are faculty, agricultural extensions have faculty, and medical school clinicians are faculty. Moreover, many universities have research faculty who are full-time research employees with non-tenure-track appointments.

Universities publish numbers that reflect their internal definition of faculty or full-time equivalent faculty, but these numbers, while accurate on their own terms, have little comparative value. Take the case of teaching faculty. A university will report a full-time faculty number, say 2,000, and then will report the number of undergraduates, say 20,000. It will then report a faculty/student ratio of 1 to 10. This number is statistically accurate but meaningless. Unless we know that all 2,000 faculty teach full time (and not spend part time on teaching and part time on research), we cannot infer anything about the experience a student will have from this ratio. If the faculty members spend half of their time on research, then the full-time teaching equivalent faculty number is actually 1,000, giving us a ratio of one faculty member for every 20 students. If, in addition, 500 of these faculty actually work only on graduate education or medical education or agricultural extension, then we have only 500 full-time teaching equivalent faculty, which gives us a ratio of one full-time teaching faculty member for every 40 undergraduate students. Since we have no data on the composition or real work commitment or assignments of the total faculty number, the value of reported faculty-student ratios becomes publicity related rather than substantive. Nonetheless, many popular rankings use these invalid student-teacher ratios as critical elements in their ranking systems.

For the research university, we cannot separate out the full-time research equivalent faculty any easier than we can identify the full-time teaching faculty. We do know, however, that in large research universities the total amount of teaching required of all the faculty is likely significantly larger than at small research universities, although the teaching course load of individual faculty at a larger university might be lower than those of the faculty at a smaller institution. As a result, comparisons of faculty productivity in research between institutions with significantly different teaching, student, and mission profiles will produce mostly spurious results.

The following table, taken from one of Denise Gater's publications from *TheCenter* on this topic, illustrates this difficulty. Note that the definitions of faculty used here reflect three common methods of counting faculty. The first, labeled Salaries, comes from the federal government's IPEDS Salaries survey that includes a definition of full-time instructional faculty. Even though this definition applies to all reporting institutions, individual institutions frequently report this number using different methods for counting the faculty included. The second definition of faculty, IPEDS Fall Staff, is a count used by many universities to report the number of faculty on staff at the beginning of each academic year. However, the methods used to define "Staff" vary by institution. To help with this, institutions also report a number related to "Tenure or Tenure Track Faculty," in the Fall Staff survey which is the third method used here. Even with this definition, there are a variety of differences in how universities report. The table includes a sample of institutions that report all three faculty counts with each institution's federal research expenditures as reported for 1998 (identified as Federal R&D Expenditures in the table). If we divide each of the institutions' federal research number by the number of faculty reported under each definition, and then rank the per-faculty productivity, we get the widely varying rank order seen in the table.

As the table shows, depending on the definition used, the relative productivity per faculty varies dramatically, and any rankings derived from such calculations become completely dependent not on faculty productivity itself but on the definitions used in counting the number of faculty, and even the ranks based on the same definition of faculty have little validity because universities apply the standard definition in quite varying ways.

At the campus level, however, it is possible and often very helpful to focus on individual colleges and even departments or programs and compare individual faculty productivity. An engineering college could compare the research grant expenditures of its faculty to the research productivity of engineering faculty at other major institutions. Chemistry faculty can compare their publication counts or citations, historians can compare the book and scholarly article productivity, and similar, discipline-specific comparisons can help institutions drive improvement. These measurements do not aggregate to an institutional total, but they do provide campuses with a method for driving productivity increases. In addition, universities can compare the teaching productivity of their faculty across different institutions, but within the same discipline. Political science departments can compare the average teaching productivity of their faculty with the productivity of political science faculty at other first-rank institutions.

These comparisons help establish standards for performance and aid in achieving increased productivity but, again, they do not aggregate into university standards very well because the appropriate teaching load in chemistry with its laboratory requirements is significantly different from the teaching load in history. Moreover, institutional comparisons at this level of detail often fail because the composition of institutional research and teaching work varies markedly. Campuses with many professional programs may teach many more upper- than lower-division courses, campuses with significant transfer populations will teach more upper-division courses, and campuses with small undergraduate populations compared to their graduate populations will teach more graduate courses. These differences affect all comparisons at the institutional level that attempt to identify efficiency or optimal productivity. Instead, for benchmarks of performance, institutions need to make their comparisons at the discipline level.

Institutions often conduct peer-group comparisons to benchmark their performance against appropriate comparator institutions, but usually the participants in these studies do so only on the condition that the data remain confidential and that reports using the data either rely on aggregate measures or report individual institutions anonymously. *TheCenter's* exploration of comparisons involving engineering and medicine will appear in further reports as the work concludes.

Impact of *TheCenter* Report

Estimating the impact of a project such as this one is challenging. Nonetheless, some indicators provide a glimpse into the utility of these data. The report appears in a variety of formats to reach the widest possible audience. Some find the printed version most accessible; others visit the Web site to use the data or download the report itself. Other Web sites refer to *TheCenter's* data, and the staff participates in the national conversation about measurement, accountability, and performance reflecting work sponsored by or inspired by *TheCenter's* activities.

For example, over the first four years, we mailed a little more than 3,000 copies of the report per year, usually with around 2,000 in the first mailing to

Effect on Ranking, Using Different Faculty Counts to Calculate Federal R&D per Faculty

Selected Private Research Institutions (n = 25)

Institution	1998 Fed R&D Expenditures ($ thousands)	Rank Using Salaries	Rank Using Fall Staff Total	Rank Using Fall Staff Ten/Ten Track
California Institute of Technology	177,748	1	1	1
Yeshiva University	80,000	3	2	2
Rockefeller University	43,845	11	4	3
Massachusetts Institute of Technology	310,741	4	3	4
Harvard University	251,876	10	6	5
Stanford University	342,426	2	5	6
Carnegie Mellon University	95,046	13	8	7
University of Pennsylvania	247,914	8	11	8
Case Western Reserve University	132,274	9	9	9
Columbia University	229,723	22	12	10
Tufts University	61,167	20	7	11
Northwestern University	127,911	17	15	12
Yale University	205,046	6	14	13
Boston University	104,428	23	24	14
Duke University	172,532	5	20	15
University of Chicago	125,982	18	19	16
Princeton University	69,005	21	9	17
Cornell University, All Campuses	204,187	16	13	18
University of Rochester	130,773	7	17	19
Vanderbilt University	106,325	14	21	20
Emory University	118,045	12	23	21
Georgetown University	84,801	15	18	22
University of Miami	101,492	19	22	23
Brown University	44,412	24	15	24
New York University	101,426	25	25	25

universities included in the report and a range of others who have expressed an interest in being included in the first mailing. The second thousand mailed responds to requests from institutions and individuals. Sometimes these are for single copies and on occasion for multiple copies for use in retreats and seminars.

Another major engagement for the report takes place through the Internet, and *TheCenter's* Web site has a significant hit rate for such a specialized resource. The first year, the site averaged 835 unique hits per week, with 3,700 per month for the August-November period. About 89% of these hits came from the United States. In 2001, the Web presence increased with an average of 6,900 unique hits per month in the same four-month time period as the 2000 report. This increase also included an increase in foreign visitors, with Web visitors logged from more than 107 countries. This pattern continued in 2002, with a first four-month average reaching 8,000 unique hits. The unique hit rate at this level appears to have stabilized for the 2003 report. *TheCenter* staff also responds to hundreds of inquiries via e-mail each year.

International interest in the report has surprised us, as we anticipated that these data would be of most interest to the American research university community. Nonetheless *TheCenter* received inquiries and requests from Venezuela, Canada, the United Kingdom, Spain, Sri-Lanka, Kenya, Japan, Sweden, India, and China. The following is a selection of visitors to *TheCenter*:

- September 2000, Rie Mori, National Institute of Academic Degrees, Japan
- July 2001, Peter Purdue, Naval Postgraduate School
- August 2002, Toyota Technical Center, USA
- October 2002, Representatives from Japan's New Energy & Industrial Technology Development Organization (NEDO); the University Administration Services Department (Kawaijuku Educational Institution); and the Mitsubishi Research Institute
- March 2003, Dr. Hong Shen, Professor of Higher & Comparative Education, Vice Dean, School of Education, Huazhong University of Science & Technology, Wuhan, Hubei 430074, P.R.China.

TheCenter's Top American Research Universities report prompted comment and review in many publications. *The Scout Report* included a reference, which undoubtedly increased the Web-based traffic, and *The Chronicle of Higher Education* cited *TheCenter's* work in an article on research institution aspirations. Newspaper stories (Arizona, New York, Indiana, Nebraska, Florida), including *The New York Times*, featured in-depth discussion of the report and its methodology. *TheCenter* and its work appear in ScienceWise.com, The University of Illinois College Rankings Web site, and the Association of Institutional Research resource directory, as well as in the higher education sections of most Internet search engines such as Google and Excite. As another example of the international interest in this topic, the International Ranking of World Universities, available online, includes *The Top American Research Universities* in its list of sources, even though this ranking system takes a somewhat different approach to the task. The following table samples some of the many institutions and organizations that use or cite *The Top American Research Universities* report and data. A search through Google turns up many more than these, of course.

Association of American Universities: "About Research Universities" website. [http://www.aau.com/resuniv/research.cfm]

Boston College: Research Guide: Educational Rankings. [http://www.bc.edu/libraries/research/guides/s-edurank/]

Case Western Reserve University: Ranks among the top 20 private research universities nationally, according to TheCenter at the University of Florida. TheCenter ranks universities on nine indicators, including research support, significant awards to faculty, endowment assets, annual private contributions, doctorates awarded, and average SAT scores. Case ranks among the top 25 private universities on eight of the nine indicators. Among all research universities, public and private, Case ranks among the top 50 in seven of the nine categories. (*The Top American Research Universities*, August 2003). [http://www.case.edu/president/cir/cirrankings.htm#other]

Distance Learning, About: America's Best Colleges and Universities – Rankings. Top American Research Universities. Rankings of public and private research universities based on Measuring University Performance. From TheCenter at the University of Florida. [http://distancelearn.about.com/cs/rankings/a/univ_rankings_2.htm]

Feller, Irwin, "Virtuous and Vicious Cycles in the Contributions of Public Research Universities to State Economic Development Objectives," Economic Development Quarterly, Vol. 18, No. 2, 138-150 (2004) **(Cited in)** [http://edq.sagepub.com/cgi/content/refs/18/2/138]

Globaldaigaku.com: Study Abroad. The Top American Research Universities 2002 (TheCenter Rankings). *TheCenter* includes only those institutions that had at least $20 million in federal research expenditures in fiscal year 2000, and determines their rank on nine different measures. [http://www.globaldaigaku.com/global/en/studyabroad/rank/list.html]

Midwestern Higher Education Compact: Midwest Ranks Prominently in Rating of America's Top Research Universities. [http://www.mhec.org/pdfs/mw_top_univs.pdf]

Scout Report, The: The Top American Research Universities 2001 [Excel, .pdf]. An updated version of The Top American Research Universities has been released from Florida-based research organization, The Center, which creates this report annually. (The first edition of The Top American Research Universities was included in the July 28, 2000 *Scout Report*.) [http://scout.wisc.edu/Reports/ScoutReport/2001/scout-010907-geninterest.html]

Shanghai Jiao Tong University: Institute of Higher Education, Academic Rankings of World Universities. [http://ed.sjtu.edu.cn/rank/2004/Resources.htm]

Southeastern Universities Research Association, Inc.: SURA Membership Statistics. February 2001, Compiled by the (SURA). Top American Research Universities. Source: TheCenter at the University of Florida. *The TopAmerican Research Universities*, July 2000. [http://www.sura.org/welcome/membership_statistics_2001.pdf]

Templeton Research Lectures, The Metanexus Institute: The Metanexus Institute administers the Templeton Research Lectures on behalf of the John Templeton Foundation. U.S. list of top research universities is taken from the Lombardi Program on Measuring University Performances, *The Top American Research Universities*, 2002. [http://www.metanexus.net/lectures/about/index.html]

Texas A&M University: Florida Report Names Texas A&M One of Top Research Universities. 10/7/02. [http://www.tamu.edu/univrel/aggiedaily/news/stories/02/100702-5.html]

University of Arkansas: 2010 Commission: Making the Case. The Impact of the University of Arkansas on the Future of the State of Arkansas, Benchmarking. "… it is instructive to compare more specifically the University of Arkansas and Arkansas to the peer institutions and states in three categories: university research productivity, faculty quality, doctoral degree production, and student quality; state population educational levels and economic development linked to research universities; and state and tuition support for public research universities. The first objective can be achieved by using data from a recent report, *The Top American Research Universities*, published by *TheCenter*, a unit of the University of Florida. TheCenter's ranking of top research universities is based on an analysis of objective indicators in nine areas: [http://pigtrail.uark.edu/depts/chancellor/2010commission/benchmarking.html]

University of California—Irving: UC Irvine's Rankings in The Top American Research Universities Reports. [http://www.evc.uci.edu/planning/lombardi-0104.pdf]

University of California—Santa Barbara: UCSB Libraries, Educational Rankings [http://www.library.ucsb.edu/subjects/education/eddirectories.html]

University of Cincinnati: Research Funding Hits Record High. UC Hits Top 20 in the Nation, Date: Oct. 23, 2001. The University of Cincinnati earned significant increases in total external funding during the 2001 fiscal year, including more than $100 million in support for the East Campus. The report follows UC's ranking among the Top 20 public research universities by the Lombardi Program on Measuring University Performance. The program, based at the University of Florida, issued its annual report, *The Top American Research Universities*, in July 2001. [http://www.uc.edu/news/fund2001.htm]

University of Illinois—Urbana-Champaign: Library. Top American Research Universities. Methodology: This site offers an explanation of its rankings on a page titled Methodology. This report identifies the top public and private research universities in the United States based upon nine quality

measures. Universities are clustered and ranked according to total and federal research funding, endowment assets, annual giving, National Academy membership, prestigious faculty awards, doctorates awarded, postdoctoral appointees, and SAT scores of entering freshmen. Also available are lists of the top 200 public and private universities on each quality measure. The site includes other reports and resources on measuring university performance. The report and Web-based data are updated annually in mid-summer. [http://www.library.uiuc.edu/edx/rankgrad.htm]

University of Iowa: Report lists UI among top American research universities (University of Iowa). [http://www.uiowa.edu/~ournews/2002/november/1104research-ranking.html]

University of Minnesota: Aug. 23, 2001 (University of Minnesota) New Ranking Puts 'U' Among Nation's Elite Public Research Universities [http://www.giving.umn.edu/news/research82301.html]

University of Nebraska—Lincoln: UNL Science News. NL Earns Spot in 'Top American Research Universities' Ranking, Aug. 30, 2000 [http://www.unl.edu/pr/science/083000ascifi.html]

University of North Carolina—Chapel Hill: A recent report about the top American research universities cited UNC-Chapel Hill as one of only five public universities ranked in the top 25 on all nine criteria the authors used to evaluate the quality of research institutions. The other four universities were the University of California-Berkeley, the University of California-Los Angeles, the University of Michigan-Ann Arbor, and the University of Wisconsin-Madison. Updated 09/2004 [http://research.unc.edu/resfacts/accomplishments.php]

University of Notre Dame: Report on Top American Research Universities for 2003 is Released, posted 12/04/03.The 2003 Lombardi report on The Top American Research Universities is now available. It provides data and analysis on the performance of more than 600 research universities in America. Among the nine criteria used in the report are: Total Research, Federal Research, National Academy Members, and Faculty Awards. [http://www.nd.edu/~research/Dec03.html]

University of South Florida: USF is classified as Doctoral/Research Extensive by the Carnegie Foundation for the Advancement of Teaching, and is ranked among the top 100 public research universities in the annual report "The Top American Research Universities." [http://www.internationaleducationmedia.com/unitedstates/florida/University_of_southern_florida.htm]

University of Toronto: Governing Council, A Green Paper for Public Discussion Describing the Characteristics of the Best (Public) Research Universities. Citation: E.g., in the United States: …., the rankings of John V. Lombardi, Diane D. Craig, Elizabeth D. Capaldi, Denise S. Gater, Sarah L. Medonça, *The Top American Research Universities* (Miami: *The Center*, the University of Florida), 2001. [http://www.utoronto.ca/plan2003/greenB.htm]

Utah State University: Utah State University, Research Ranking TheCenter's Report: The Top American Research Universities. TheCenter is a reputable non-profit research enterprise in the U.S., which focuses on the competitive national context for major research universities. [http://www.tmc.com.sg/tmc/tmcae/usu/]

Virginia Research and Technology Advisory Commission: ***Elements for Successful Research in Colleges and Universities.*** This summary of descriptive and analytic information is based on the findings of: (1) recent national scholarship on "top American research universities;" [Citation is to TheCenter].[http://www.cit.org/vrtac/vrtacDocs/schev-researchelements-05-21-03.pdf]

This visibility led to requests for *TheCenter's* staff to address a wide range of audiences including university groups in Louisiana, South Carolina, Pennsylvania, and Massachusetts as well as invited presentations at international meetings in China and Venezuela. *TheCenter's* staff also provided invited presentations to the National Education Writers Association, the Council for Advancement and Support of Education, a Collegis, Inc., conference, the National Council of University Research Administrators, the Association for Institutional Research, the Association of American Universities Data Exchange (AAUDE), and another presentation at a Southern Association of College and University Business Officers meeting.

Although we have received many comments reflecting the complexity and differing perspectives on comparative university performance, a particularly interesting study will appear in a special issue of the *Annals of Operations Research on DEA* (Data Envelopment Analysis) on "Validating DEA as a Ranking Tool: An Application of DEA to Assess Performance in Higher Education" (M.-L. Bougnol and J.H. Dulá). This study applies DEA techniques to *The Top American Research Universities* to test the reliability of *TheCenter's* ranking system and indicates that at least in using this technique, the results appear reliable.

Future Challenges

Although this report concludes the first five-year cycle of *The Top American Research Universities*, the co-editors, the staff, and our various institutional sponsors believe that the work of *TheCenter* has proved useful enough to continue. With the advice of our Advisory Board, whose constant support and critiques have helped guide this project over the past years, we will find appropriate ways to continue the work begun here.

Notes

TheCenter Staff and Advisory Board

Throughout the life of *TheCenter*, the following individuals have served on the staff in various capacities, including the authors of this report: John V. Lombardi, Elizabeth D. Capaldi, Kristy R. Reeves, and Denise S. Gater. Diane D. Craig, Sarah L. Mendonça, and Dominic Rivers appear as authors in some or all of the previous four reports. In addition, *TheCenter* has enjoyed the expert and effective staff

assistance of Lynne N. Collis throughout its existence, the technical help of Will J. Collante for Web and data support, and the many contributions of Victor M. Yellen through the University of Florida Office of Institutional Research. As mentioned in the text, financial support for *TheCenter's* work comes from a gift from Mr. Lewis M. Schott, the University of Florida, the University of Massachusetts, and the State University of New York.

The current Advisory Board to *TheCenter* has been actively engaged with this project and its publications for the five years of its existence. Their extensive expertise, their lively discussions at our meetings, and their clear critiques and contributions to our work have made this project possible. They are: Arthur M. Cohen (Professor Emeritus, Division of Higher Education, Graduate School of Education and Information Studies, University of California, Los Angeles), Larry Goldstein (President, Campus Strategies, Fellow, SCT Consultant, NACUBO), Gerardo M. Gonzalez (University Dean, School of Education, Indiana University), D. Bruce Johnstone (Professor of Higher and Comparative Education, Director, Center for Comparative and Global Studies in Education, Department of Educational Leadership and Policy, University of Buffalo), Roger Kaufman (Professor Emeritus, Educational Phychology and Learning, Florida State University, Director, Roger Kaufman and Associates, Distinguished Research Professor, Sonora Institute of Technology), and Gordon C. Winston (Orrin Sage Professor of Politial Economy, Emeritus, and Director, Williams Project on the Economics of Higher Education, Williams College).

TheCenter Reports

The Myth of Number One: Indicators of Research University Performance (Gainesville: TheCenter, 2000) engaged the issue of rankings in the very first report that discusses some of the issues around the American fascination with college and university rankings. Here, we describe the indicators *TheCenter* uses to measure research university performance, and in all the reports we include a section of notes that explain the sources and any changes in the indicators. The 2000 report also includes the first discussion of the large percentage of federal research expenditures controlled by the more than $20 million group—a dominance that remains, as demonstrated in the 2004 report. A useful discussion of the most visible popular ranking system is in Denise S. Gater, *U.S. News & World Report's Methodology* (Gainesville: *TheCenter*, 2001, Revised) [http://thecenter.ufl.edu/usnews.html], and Gater, *A Review of Measures Used in U.S. News & World Report's "America's Best Colleges"* (Gainesville: *TheCenter,* 2002) [http://thecenter.ufl.edu/Gater0702.pdf]. For a discussion of the graduation rate measure, see Lombardi and Capaldi, "Students, Universities, and Graduation Rates: Sometimes Simple Things Don't Work" (*Ideas in Action*, Florida TaxWatch, IV:3, March 1997).

Quality Engines: The Competitive Context for American Research Universities (Gainesville: *TheCenter*, 2001) [http://thecenter.ufl.edu/QualityEngines.pdf] offers a detailed description of the guild structure of American research universities and discusses the composition, size, and scale of research universities. This report also reviews the relationship between enrollment size and institutional research performance, describes the impact of medical schools on research university performance, and displays the change in federal research expenditures over a 10-year period using constant dollars. The current report (2004) looks at the past five years and provides data on eight of the nine indicators.

University Organization, Governance, and Competitiveness (Gainesville: *TheCenter*, 2002) [http://thecenter.ufl.edu/UniversityOrganization.pdf] explores the organizational structure of public universities, discusses university finance, and explores a technique for estimating the revenue available for investment in quality by using an adjusted endowment equivalent measure. We also review here the impact of enrollment size on disposable income available for investment in research productivity. Given the importance of revenue in driving research university competition, we also explore the impact of revenue including endowment income and annual giving in this report. Our exploration of public systems and their impact on research performance indicates that organizational superstructures do not have much impact on research performance, which as we identified in the report on *Quality Engines* depends on the success of work performed on individual campuses. Investment levels prove much more important. The notes to that report include an extensive set of references on university organization and finance. A further use of the endowment equivalent concept, as well as a reflection on the use of sports to differentiate standardized higher education products, appears in our 2003 report on *The Sports Imperative* mentioned below. See also Denise S. Gater, *The Competition for Top Undergraduates by America's Colleges and Universities* (Gainesville: *TheCenter* Reports, May 2001) [http://thecenter.

ufl.edu/gaterUG1.pdf], which provides a survey of the methods used in competition for undergraduate students along with a useful bibliography.

The Sports Imperative in America's Research Universities (Gainesville: *TheCenter*, 2003) [http://thecenter.ufl.edu/TheSportsImperative.pdf] provides an extensive discussion of the dynamics of intercollegiate sports in American universities, and focuses on the impact of Division I-A college sports, particularly football and the BCS, on highly competitive American research institutions. The report also adapts the endowment equivalent technique described above to measure the impact of major sports programs on a university's available revenue.

On the Value of a College Education

The literature on assessing the value of a college education is extensive. Lombardi maintains a course-related list of materials related to university management at *An Eclectic Bibliography on Universities* [http://courses.umass.edu/lombardi/edu04/edu04bib.pdf] that captures much of this material, although the URL may migrate each year to account for updates. Some of the items of particular interest here are Stacy Berg Dale and Alan B. Krueger, "Estimating the Payoff to Attending a More Selective College: An Application of Selection on Observables and Unobservables," *NBER Working Paper No. W7322* (August 1999) [http://papers.nber.org/papers/w7322]; James Monk, "The Returns to Individual and College Characteristics: Evidence from the National Longitudinal Survey of Youth," *Economics of Education Review* 19 (2000); 279-289; the National Center for Educational Statistics paper on *College Quality and the Earnings of Recent College Graduates* (Washington, DC: National Center for Educational Statistics, 2000) [http://nces.ed.gov/pubs2000/2000043.pdf], which addresses the question of the economic value of elite educational experience; Eric Eide, Dominic J. Brewer, and Ronald G. Ehrenberg, who examine the impact of elite undergraduate education on graduate school attendance in "Does It Pay to Attend an Elite Private College? Evidence on the Effects of Undergraduate College Quality on Graduate School Attendance," *Economics of Education Review* 17 (1998); 371-376. Jennifer Cheeseman Day and Eric C. Newburger look at the larger picture of the general return on educational attainment across the entire population in "The Big Payoff: Educational Attainment and Synthetic Estimates of Work – Life Earnings," *Current Population Reports* (Washington: U.S. Census Bureau, 2002) [http://www.census.gov/prod/2002pubs/p23-210.pdf]. George D. Kuh's longstanding work on the quality of the undergraduate experience is reflected in "How Are We Doing? Tracking the Quality of the Undergraduate Experience, 1960s to the Present," *The Review of Higher Education*, 22 (1999); 99-120.

On Institutional Improvement and Accountability

The scholarly and public commentary on improvement and accountability systems is also extensive. The course bibliography mentioned in the note above offers a good selection of this material. As an indication of the large-scale concerns this topic provokes, see, for example, Roger Kaufmann, *Toward Determining Societal Value Added Criteria for Research and Comprehensive Universities* (Gainesville: *TheCenter*, 2001) [http://thecenter.ufl.edu/kaufman1.html] and Alexander W. Astin, *Assessment for Excellence: The Philosophy and Practice of Assessment and Evaluation in Higher Education* (New York: ACE-Macmillan, 1991).

This topic is of considerable international interest as is visible in these examples. From the U.S. Committee on Science, Engineering, and Public Policy, see *Experiments in International Benchmarking of U.S. Research Fields* (Washington, DC: National Academy of Sciences, 2000) [http://www.nap.edu/books/0309068983/html/]. Urban Dahllof et al. give us the *Dimensions of Evaluation: Report of the IMHE Study Group on Evaluation in Higher Education* (London: Jessica Kingsley, 1991) that is part of an OEDC, Programme for Institutional Management in Higher Education.

The Education Commission of the States demonstrates the public insistence on some from of accountability in *Refashioning Accountability: Toward A "Coordinated" System of Quality Assurance for Higher Education* (Denver: Education Commission of the States, 1997), and Lombardi and Capaldi include a general discussion of performance improvement and accountability in "Accountability and Quality Evaluation in Higher Education," *A Struggle to Survive: Funding Higher Education in the Next Century,* David A. Honeyman et al., eds., (Thousand Oaks, Calif.: Corwin Press, 1996, pp. 86-106) and a case study of a quality improvement program in their *A Decade of Performance at the University of Florida, 1900-1999* (Gainesville: University of Florida Foundation, 1999 [http://jvlone.com/10yrPerformance.html].

On the issues associated with using faculty data and other inappropriate techniques for comparing university performance, see Gater, *Using National Data in University Rankings and Comparisons* (*TheCenter* 2003) [http://thecenter.ufl.edu/gaternatldata.pdf], and her *A Review of Measures Used in U.S. News & World Report's "America's Best Colleges"* (*TheCenter* 2002) [http://thecenter.ufl.edu/Gater0702.pdf], and Gater and Lombardi, *The Use of IPEDS/AAUP Faculty Data in Institutional Peer Comparisons* (*TheCenter* 2001) [http://thecenter.ufl.edu/gaterFaculty1.pdf].

For some additional examples of the discussion on university improvement, see Lombardi, "Competing for Quality: The Public Flagship Research University," (Reilly Center Public Policy Fellow, February 26-28, 2003, Louisiana State University [http://jvlone.com/Reilly_Lombardi_2003.pdf] and his "University Improvement: The Permanent Challenge," (*Prepared at the Request of President John Palms, University of South Carolina, TheCenter 2000) [http://jvlone.com/socarolina3.htm]* February 2000. For a discussion of a particular effort to measure university performance that emphasizes the comparison of colleges between universities rather than colleges within universities, see Lombardi and Capaldi, *The Bank,* an issue in the series on *Measuring University Performance* [http://www.ir.ufl.edu/mups/issue_0997.htm].

Also of interest on the topic of improvement and accountability are Lombardi, "How Classifications Can Help Colleges," *Chronicle of Higher Education* (9/8/2000) [http://jvlone.com/chron090800.html]; "Statewide Governance: The Myth of the Seamless System," Peer Review (American Association of Colleges and Universities, 2001) [http://jvlone.com/lombardiAACU2001.pdf]; *Generadores de Calidad: Los Principios Estratégicos de las Universidades Competitivas en el Siglo XXI* (presented at the Simposio Evaluación y Reforma de la Educación Superior en Venezuela, Universidad Central de Venezuela, 2001) [http://jvlone.com/UCV_ESP_1.html English version at http://jvlone.com/UCV_ENG_1.html].